Using Harvard ChartXL for Windows

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for Windows

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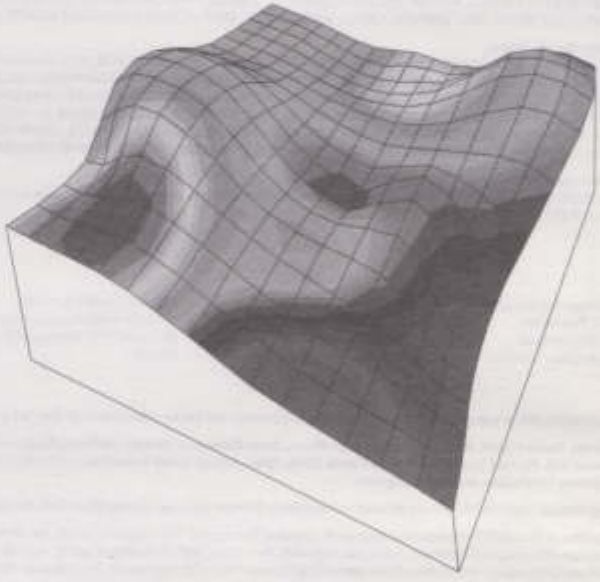
Harvard® for Windows™ ChartXL™

Using Harvard ChartXL



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Software Publishing Corp.
P.O. Box 54983
3165 Kifer Road
Santa Clara, CA 95056-0983
USA

Software Publishing Corp.
Pyramid House
Easthampstead Road
Bracknell, Berkshire RG12 1YW
UK

Software Publishing Corp.
1595 Sixteenth Avenue, Suite 303
Richmond Hill, Ontario L4B 3N9
Canada

Software Publishing Corp.
20 Collyer Quay
14-03A/04 Tung Centre
Singapore 0104

Software Publishing Corp.
Oskar-Messter-Strasse 24
D 85737 Ismaning
Germany

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Installing Harvard ChartXL

Installing Harvard ChartXL

Required: an IBM-compatible 386 computer or better, DOS 5.0 or higher, Microsoft Windows 3.1 or higher or Microsoft Windows NT, 4 MB RAM, 5 MB of free space on the hard disk (for minimum install) a monitor and graphics card set up in VGA or better.

Recommended: 8 MB RAM, Microsoft-compatible mouse, 486/33 computer or better, at least 14 MB of free space on the hard disk.

To install Harvard ChartXL:

1. Insert Disk 1 into drive A.
2. In Windows, choose **Run** from the File menu, and type **a:install.**
3. Follow the instructions on the screen, inserting and removing additional disks.
4. When the installation is complete, you'll see a Harvard ChartXL group on your desk top and a program icon you can use to start Harvard ChartXL.

Notes: The installation program does not modify your AUTOEXEC.BAT or CONFIG.SYS file.

If you want to install the minimum files, when you are asked to select options for installation, select only **Harvard ChartXL Program**. This installs the program files and the Graph Gallery files. You also can choose whether to install the online Help or import/export filters.

Registration

Be sure to return your registration card! As a registered user, you'll be eligible for technical support assistance and receive prompt notice of upgrades for Harvard ChartXL.

Learning to Use Harvard ChartXL

The Harvard ChartXL interface has onscreen messages and bitmap images that will help you use the product to analyze and graph your data. The onscreen Advisor tells you how to use the many different graph types that come with Harvard ChartXL. In addition, you can use the printed guide and online Help to learn the basic and advanced features of the program.

About This Guide

The chapters in this guide cover the following topics:

- Installing Harvard ChartXL (Chapter 1)
- The basics of creating graphs and working in Harvard ChartXL (Chapter 2)
- Working with spreadsheets and tables to enter, organize, and analyze data for graphs (Chapter 3)
- Using Harvard ChartXL's built-in functions and formula capabilities (Chapter 4)
- Setting options to design graphs (Chapter 5)
- How to enhance Harvard ChartXL graphs with graphic and text objects (Chapter 6)
- Using the Harvard ChartXL business graphs (Chapter 7)
- Using the Harvard ChartXL technical graphs (Chapter 8)
- Using the Harvard ChartXL statistical graphs (Chapter 9)

About Help

If you install the online Help, you can use it to find information that you need by:

- Choosing the **Create a Graph** item on the Help menu and then selecting either a new graph, an existing graph, or a graph from the Graph Gallery.
- Choosing the **Contents** item on the Help menu and then moving to topics and subtopics you want.
- Choosing the **Search for Help on** item on the Help menu and then typing in the topics you're looking for.
- Pressing F1.

The Basics

About Harvard ChartXL

In Harvard ChartXL, you can create over 47 different types of graphs. Each Harvard ChartXL file displays as a single page on your screen. You can add as many graphs as you need on a page, within the limits of your computer system. You can add text and graphic objects, too.

To create and save a graph, you must have a supporting spreadsheet for it. You work with a spreadsheet in the Harvard ChartXL Spreadsheet window, where you can enter or import data, edit it, and analyze it.

Harvard ChartXL also has a gallery of over 180 preformatted graphs that you can use as templates for your own graphs.

In Harvard ChartXL, a graph represents "live" data. You can inspect, analyze, and modify spreadsheet data by manipulating the related graph.

In the Harvard ChartXL Main window, you can use a number of tools to work with data and enhance the appearance of your graphs.

Starting, Saving, and Stopping

To start Harvard ChartXL from the Windows Program Manager:

Click the Harvard ChartXL icon in the Harvard ChartXL group window. You can then open a file or create a new one. See *Creating a Graph*.

To start Harvard ChartXL using OLE:

1. In an OLE-compatible client application, choose the Insert OLE object item (usually on the Edit or Insert menu).
2. Select Harvard ChartXL page from the list of OLE object types and click OK.

   Harvard ChartXL opens and you can add a graph. Choose **Update** from the Harvard ChartXL File menu to embed the Harvard ChartXL object in the client application.

Note: You can also use OLE to link a Harvard ChartXL file to another OLE-compatible application. For more about OLE objects, see your Windows documentation.

To save a Harvard ChartXL file:

Choose **Save** or **Save As** from the File menu.

To close a Harvard ChartXL file:

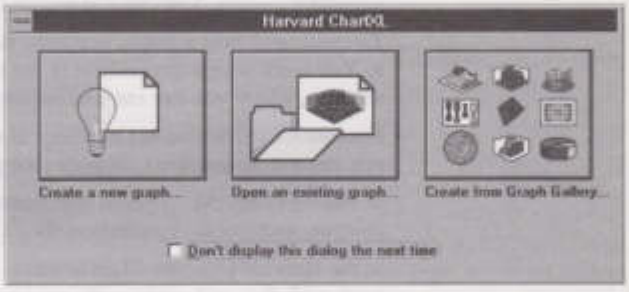
Choose **Close** from the File menu to close a file without leaving Harvard ChartXL. Choose **Exit** from the File menu to close the program and the file.

Creating a Graph

Harvard ChartXL allows you to create 2-dimensional or 3-dimensional business, technical, and statistical graphs.

The following abbreviated steps are explained more fully in the sections that follow this one (related topics).

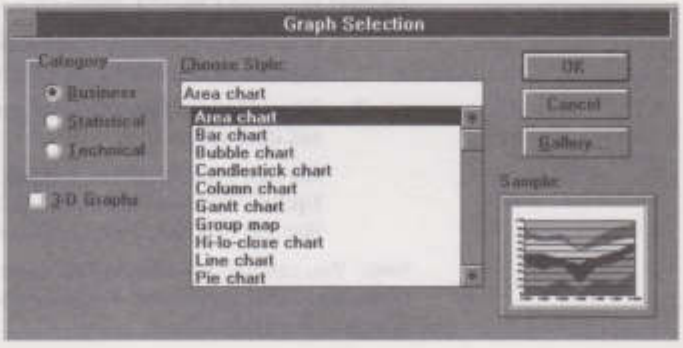
1. Start Harvard ChartXL. A dialog box opens.



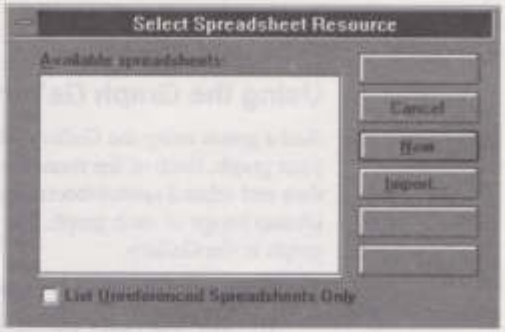
2. Click Create a new graph.

   To create a graph from the Graph Gallery, which has graph templates and sample data, click Create from Graph Gallery.

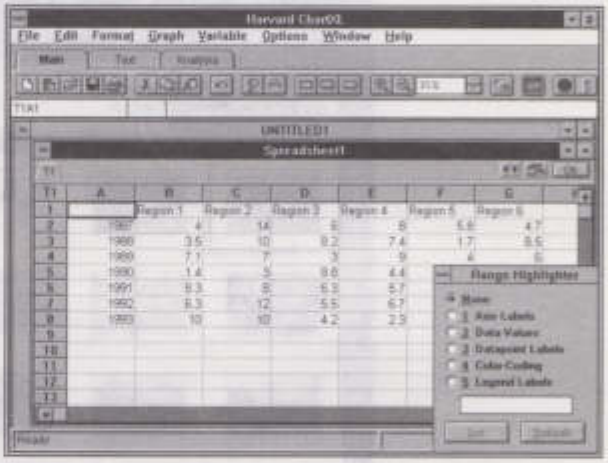
3. In the Graph Selection dialog box, select the category of graphs that you want to choose from, for example, Technical. Then select the type of graph you want to create, for example, Contour plot. Click OK.



4. In the Select Spreadsheet Resource dialog box, click New to open a blank spreadsheet.



5. Enter data in the spreadsheet.



6. Click OK to close the spreadsheet and display your graph in the Main window.
7. Choose **Save** from the File menu and type a filename.

   Harvard ChartXL saves the file with a .HCX extension. The spreadsheets used to create a graph are saved with the file.
8. Optionally, choose **Print** from the File menu to print the graph.

Notes: To add additional graphs, choose **Add Graph** from the Graph menu or click the Add Graph button.

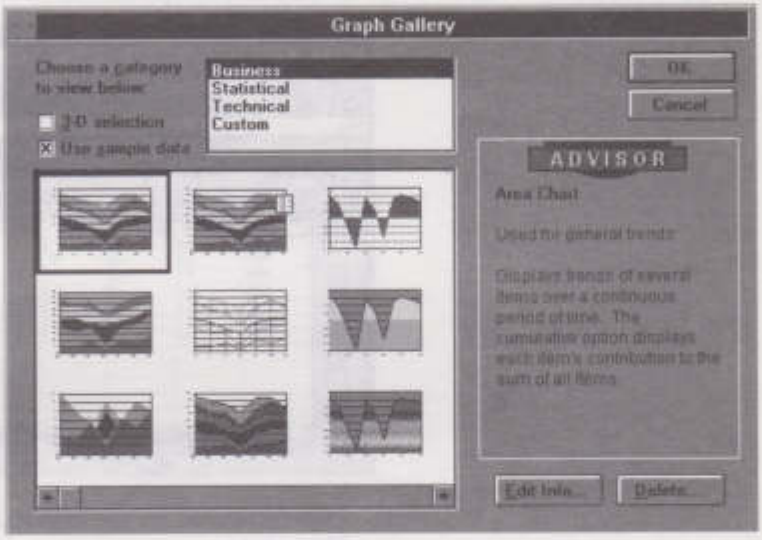
To open an existing Harvard ChartXL file at any time, choose **Open** from the File menu or click the Open button.

Using the Graph Gallery

Add a graph using the Gallery when you want a predesigned template for your graph. Each of the more than 180 graphs in the Gallery has sample data and related spreadsheets. As you scroll through the gallery, you see a bitmap image of each graph. The Advisor has information about each graph in the Gallery.

To create a graph using the Gallery:

1. Start Harvard ChartXL and choose Create from Graph Gallery in the opening dialog box.



   Click a graph to see the Advisor information about it.

2. In the Graph Gallery dialog box, select the category of graph you want to choose from.

   Select 3-D if you want to see 3-D graphs.

3. Scroll to find the graph that you want; then select it.
4. Click OK to see the spreadsheet and sample data for the graph.
5. Replace the sample data with your own.
6. Use the Range Highlighter to shorten or lengthen the data ranges for the graph if necessary.

Notes: You can also drag a graph from the Gallery to your page.

If you want to have one of your own graphs available as a template for others, save it in the Graph Gallery. See *Adding a Graph to the Graph Gallery* in **Working with Graphs**.

Using the Select Spreadsheet Resource Dialog

Choose options in this dialog box to create, import, or edit a spreadsheet within the current graph file.

To use this kind of data for a graph:	Do this:
A spreadsheet already used in the current file	Click the spreadsheet in the list under Available Spreadsheets. Then click Display
Data or text from an external file	Click Import and click the file type you want in the file type list. Then, select the filename you want. (External files include Harvard ChartXL spreadsheets that have been saved externally as ASCII files with a .DAT extension). For more information about importing data, see *Importing Data Files* in **Working with Spreadsheets**.

Spreadsheet Basics

By default, a spreadsheet displays data in one table. You can add up to 254 additional tables to organize your data.

When you display a spreadsheet that's associated with a selected graph, you also see a Range Highlighter dialog box for the graph.

For more information, see **Working with Spreadsheets**.

Viewing a Spreadsheet

To jump to a specific spreadsheet for a graph or for one of the curves on the graph, select the graph or curve. (See *Selecting, Moving, and Resizing*.) Click the Open Spreadsheet button. The spreadsheet and Range Highlighter open.

To view any of the spreadsheets in your current file, or to import a new one, click the Open Spreadsheet button or choose **Spreadsheet** from the View menu without first selecting a curve or graph. This opens the Select Spreadsheet Resource dialog box.

The Range Highlighter

The Range Highlighter is used to help you plot data on a graph. It displays the ranges (or locations) of data that are currently used in the selected graph. It also allows you to change and define the ranges that you want to plot.

To view ranges currently in use by a graph, click each item in the Range Highlighter dialog box. (The current range for each item shows in the white box at the bottom of the dialog box.)

Setting Ranges

To change a range for a graph:

1. In the Range Highlighter dialog box, click the item you want to change.
2. In the spreadsheet, select the new range.

   The new range is shown in the box.
3. Click Set.

You can also select the item you want to change in the Range Highlighter dialog box and type in the new range.

The syntax for ranges is as follows:

- The T1 designation in a range means Table 1 of the spreadsheet. It is not necessary to type this in when entering ranges in a single table, as the current table is the assumed default. (Spreadsheets have at least one table, and can have more than one.)
- The dollar signs are cell "anchors" that are used in the same way you would use them in Excel or Lotus 123.
- The colon (:) symbol in a range means "through."

For more about using the Range Highlighter, see *Setting and Viewing Graph Ranges* in **Working with Spreadsheets**. For information about the default ranges used for each Harvard ChartXL graph type, see **Business Graphs**, **Technical Graphs**, and **Statistical Graphs**.

Modifying a Graph

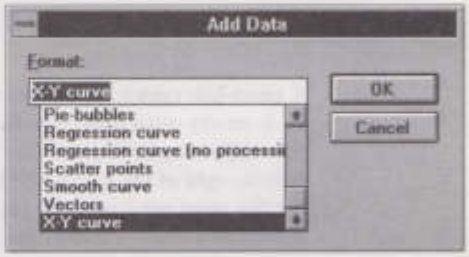
To change the attributes of a graph, you can usually begin by selecting the graph or a data set. Then click the right mouse button to see a context-sensitive menu that lists options for formatting and for changing other options. For example, you can add a legend, change the colors used, add a title for an axis, and change the symbols used to show data points on a curve. Each graph type has its own unique options, allowing for many variations. You can experiment with these options to see how each variation affects a graph.

For information on setting graph style options and other options, see **Working with Graphs**, **Business Graphs**, **Technical Graphs**, and **Statistical Graphs**.

Adding a Data Set

You can plot additional data on an existing graph. A Harvard ChartXL graph can display any number of curves from a variety of spreadsheets.

1. Select the graph.
2. Choose **Add Data** from the Graph menu.



3. Choose the format for your data, for example X-Y curve, and click OK.
4. In the Select Spreadsheet Resource dialog box, click New to see a new spreadsheet for the data set.

   You can also click Import to open an external file such as an Excel spreadsheet.
5. Type the data in the spreadsheet and click OK to see the graph with the new data.

Note: Sometimes a portion of the screen will not redraw entirely due to the use of multiple dialog boxes. To redraw the entire screen at any time, click the Redraw button on the tool bar.

Changing and Analyzing Data

It's easy to change data in Harvard ChartXL. Graphs on-screen represent "live" spreadsheet data that is always active and attached to the curves you see. If the data changes, so does the graph. Conversely, if the curve changes, so does the data itself. This interaction between graphics and data provides you with a great degree of flexibility and control when viewing and analyzing your data.

Harvard ChartXL also has data analysis tools that allow you to spot significant trends.

Using the Data Exploration Cursor

The Data Exploration Cursor provides a visual link between the graph and the spreadsheet and lets you manipulate and change data without opening the spreadsheet.

To use the Data Exploration Cursor, select a data set (such as a curve for an XY plot). (See *Selecting Data*.) Click the Analysis tab at the top of the screen. Click the Data Exploration Cursor button.

A cross-hair cursor appears on the first data point. To move this cursor, click on any other data point for that data set, or use the arrow keys. Information regarding each data point is shown in two locations. At the bottom right of the screen, the legend label and other helpful information for that point are displayed, such as an X value. At the top center of the screen, in a white window, the Y value and spreadsheet cell show.

Click the white window at the top of the screen to type in changes to your data. (Click the green check button in the tool that appears in the window, to verify your entry.) The graph redraws with the new Y value and the spreadsheet for the graph is updated.

You can also drag a data point that you've selected with the Data Cursor to change its value. As you do, the value changes in the window. When you stop dragging you are asked to confirm the new value. If you do, the new value is entered in the spreadsheet for the data set. If your original data file was an external file, that original file is not altered.

Note: Harvard ChartXL data can be linked, or connected, to an external file. (For more information about links, see *Using Data from Other Applications* in **Working with Spreadsheets**.) Changes to spreadsheet data from a linked file are displayed in the spreadsheet as gray cells, or Tags. The new data is stored in the Harvard ChartXL spreadsheet and not written back to the original file. To remove a Tag and return to the original data, select the tagged cell and choose **Clear Tag** from the Edit menu.

Automatic Processing Graphs

Several of the statistical and technical graph types that Harvard ChartXL provides will automatically process raw data before drawing the graph. You add a graph of this type like you do other graphs.

The automatic processing graphs are:

- Surface plots
- Contour plots
- Error Bar charts
- Box-Whisker plots (2-D and 3-D)
- Histograms (2-D and 3-D)
- Pareto charts

Automatic processing graphs transform raw data into a processed curve, and then plot the resulting data.

For all the automatic processing graph types, once a graph is drawn, you can alter its parameters by first selecting the data with the mouse, then choosing **Edit Processing** from the Graph menu and changing the parameters.

Note: For some of the automatic processing graphs, there is also a *no processing* option. Choose this option when graphing data that has already been processed.

For more information on the automatic processing graphs, see *Error-Bar Plots and Column-Error Plots*, *Box-Whisker Plots*, *Pareto Charts*, and *Histograms* in **Statistical Graphs** and *Contour Plots* and *Surface Plots and Spectral Plots* in **Technical Graphs**.

Tips for Working with Data and Objects

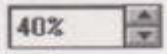
Harvard ChartXL provides efficient ways to work with data and change the appearance of a graph. Tool bars allow you to click an icon button to do common tasks, drawing tools let you click to add objects to a graph, and you can use the mouse and keyboard to perform a number of operations, including selecting and resizing graphs and other objects.

The Dynamic Tool Bar

A tool bar is available in the Main window and the Spreadsheet window. The tools available depend on which tool bar tab (Main, Text, or Analysis) has been selected.

To turn the tool bar on and off, choose **Tool Bar** on the View menu.

The Main Tool Bar

Click:		To:
	**New File**	Open a new file
	**New Spreadsheet**	Open a new spreadsheet
	**Open**	Open an existing file
	**Save**	Save the current file
	**Print**	Print the current graph or spreadsheet
	**Cut**	Cut the selected object(s) to the clipboard
	**Copy**	Copy the selected object(s) to the clipboard
	**Paste**	Insert the contents of the clipboard onto the current page or spreadsheet
	**Undo**	Reverse the last action you took
	**Fill**	Toggle the Fill off and on for a selected object(s)
	**Color**	Change the colors of a selected object(s)
	**Single Frame**	Apply a single frame style to the selected object(s)
	**Offset Frame**	Apply an offset frame style to the selected object(s)
	**Raised Frame**	Apply a raised frame style to the selected object(s)
	**Zoom**	Enlarge an area of the page for viewing
	**Unzoom**	Return to Fit to Page view
		Set the view percentage
	**Rotate**	Rotate a graph

	**Open Spreadsheet**	Open an existing spreadsheet
	**Halt Redraw**	Interrupt a screen redraw
	**Redraw**	Redraw the screen

The Text Tool Bar

Click:		To:
	**Bold**	Format selected text as bold
	**Italics**	Format selected text as italics
	**Underline**	Format selected text as underlined
	**Left**	Format selected text as left justified
	**Center**	Format selected text as center justified
	**Right**	Format selected text as right justified
	**Full**	Format selected text as fully justified

The Analysis Tool Bar

Click:		To:
	**New Spreadsheet**	Open a new spreadsheet
	**Data Exploration Cursor**	View and change data
	**Formula Solver**	Graph a formula or make a quick calculation
	**Rotate**	Rotate a graph
	**Open Spreadsheet**	Open an existing spreadsheet
	**Halt Redraw**	Interrupt a screen redraw
	**Redraw**	Redraw the screen

The Drawing Tools

Harvard ChartXL also has drawing tools, which you can move where you want in the Main window.

To turn the drawing tools on and off, choose **Drawing Tools** on the View menu.

Click:		To:
	**Cursor**	Activate the selection tool
	**Caption**	Add text annotations to the slide
	**Line**	Draw a line
	**Rectangle**	Draw a rectangle
	**Arrow**	Draw an arrow
	**Arc**	Draw an arc
	**Wedge**	Draw a wedge
	**Polyline**	Draw a polyline
	**Polygon**	Draw a polygon
	**Circle**	Draw a circle
	**Bezier**	Draw a Bezier curve
	**Add Graph**	Add a new graph

Context-Sensitive Menus and Other Shortcuts

The following is a list of shortcuts for common tasks. For many tasks, you can select an object in the Main window, click the right mouse button, and choose items from a context-sensitive menu.

To:	Do this:
Edit an object	Double-click the object.
Change an axis style	Select the axis with the mouse, click the right mouse button, and choose Axis style from the context-sensitive menu.
Change the style of a graph	Select the graph with the mouse, click the right mouse button, and choose items from the context-sensitive menu.
Select a spreadsheet range	Click on the column letter or row number to select an entire range. Drag with the left mouse button to highlight a specific range.
Display a different spreadsheet table	Select the corresponding tab at the top of the Spreadsheet window.

Selecting, Moving, and Resizing

You can select and move graphs, objects that are part of a graph, text captions, and other graphical objects. You can also resize graphs and objects.

Selecting a Graph and Other Single Objects

Select an entire graph as a single object by clicking in the top part of the graph or just outside the top of the graph.

Graphs are composed of multiple objects (axis, axis labels, axis title, data sets, and so on), and you can select any of these objects independently. In addition to graphs, you can select a text block, image, drawing, or other objects that you've added to a page.

To select a single object, click the object with the left mouse button. The message bar at the bottom left of the screen tells what object is selected (e.g., Edit Graph).

You can select objects in succession by pressing the Left and Right Arrow keys or Tab and Shift+Tab. The movement occurs in the order that the objects were drawn on the screen.

Selecting Multiple Objects

To select a group of objects, select one object and then press the Shift key while you click on each additional object. Or, use the mouse to drag a selection box around the objects.

Selecting Data

Click once on a data set to select all the data points in a series.

Click again on any single data point and that point is selected.

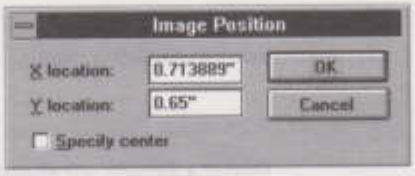
Click again on the same data point, and, if you have multiple data series plotted, all similar data points in each data series are selected.

Click on any data set with the Ctrl key held down to select all data series for a single data set.

Moving Selected Objects

Use either of these methods:

- Drag the selected object or objects to a new location. If multiple objects have been selected, they move together as a single unit.
- Select an object or objects and choose **Move** from the Arrange menu. In the Image Position dialog box, type a new location (in X,Y coordinates) for the selected object. If multiple objects have been selected, they are placed in the same position on the slide, on top of each other.



X location	Use this to specify the distance of the selected object from the left side of the page
Y location	Use this to specify the distance of the selected object from the top of the page.
Specify center	If checked, indicates that coordinates refer to the center of the object, rather than to the top left of the object.

Choose **Show Guides** on the Arrange menu to help with the placement of objects. When you choose Show Guides, Harvard ChartXL displays a vertical and horizontal guide line on the page. The lines can be moved, and as you move them, their position shows at the bottom of the screen. Drag objects near a guide line, and they will "snap" or position themselves related to the guidelines. The objects can snap to a guide line along the top, bottom, left, and right sides of the object or at the center of the object.

For even more precise placement, choose **Snap to Grid** on the Arrange menu. This creates an invisible .10-inch grid for the page. Objects will snap to this grid as they do to the guide lines.

Resizing Objects

Select an object, click one of the handles, and drag the object to a new size. Holding down the Shift key while resizing an object forces it to remain proportional. (You can only resize one object at a time in this way.)

Or, select an object, then choose **Size** from the Arrange menu, and type a new size for the selected object. If multiple objects are selected, all the selected objects are sized to the same dimensions.

Cutting, Copying, and Pasting

Use the Windows clipboard and the Cut, Copy, and Paste commands to delete and move objects within a Harvard ChartXL file or to another Windows application. For more information about the clipboard, see your Windows documentation.

To copy an object:

Select an object and choose **Copy** from the Edit menu or click the Copy button on the Main tool bar. The object is copied and placed on the clipboard.

To cut an object:

Choose **Cut** from the Edit menu or click the Cut button on the Main tool bar. The object is deleted and placed on the Windows Clipboard.

To paste an object from the Clipboard:

Select the place you want to put the object. Choose **Paste** from the Edit menu or click the Paste button on the Main tool bar. The object is placed at the point you've selected.

Notes: Choose **Clear** from the Edit menu or press Delete on your keyboard to remove an object without placing it on the clipboard.

Use the Undo command to reverse the last Copy, Cut, Paste, or Clear commands. The Undo command works on the last action taken. Choose **Undo** from the Edit menu or click the Undo button on the Main tool bar.

For information on pasting OLE objects, see *Inserting Objects Using OLE* in **Working with Graphics and Text Annotations**.

Printing a Page

It is advisable to select and set up your printer driver before creating a graph that you'll print or produce as an overhead. This gives you the full selection of fonts available to your printer, and ensures that what you see is what you get when you print. When you select a printer, your on-screen fonts may switch to the printer fonts that are available on your printer.

Changing the page size, orientation, or printer may affect the layout of your graph. For example, if you switch from landscape to portrait page orientation, graphs that you designed with the landscape orientation might not fit properly on the new layout.

To select a printer:

Choose **Print Setup** from the File menu and make your choice in the Printer Setup dialog box.

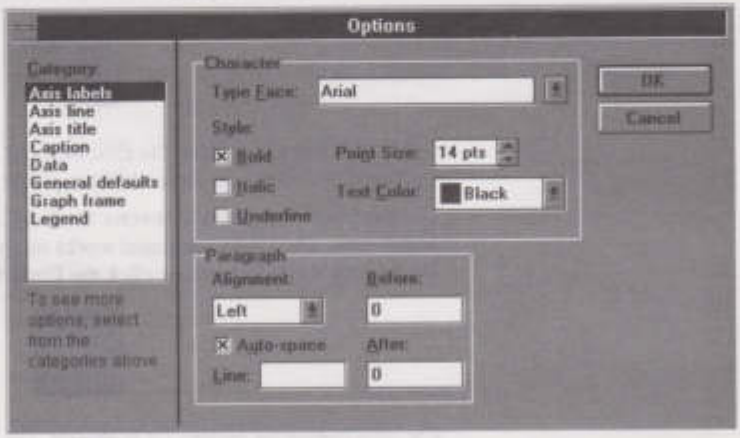
To print a page:

1. Select **Print** from the File menu.
2. Select the number of copies to print and click OK.

On printers capable of printing gray scale, all colors automatically convert to shades of gray.

Setting Program Options

Set program options to control general program defaults and set default font and line attributes for new graphs. Choose **Options** from the Tools menu to see the Options dialog box and set defaults.



General Program Defaults

To set general program defaults:

1. Choose **Options** from the Tools menu.
2. In the Options dialog box, select **General defaults**. In the right side of the dialog box, set the options that you want and click OK.

Open spreadsheet on new graphs	If selected, causes the spreadsheet window to be displayed when you create a new graph
Show mouse position	If selected, displays the horizontal and vertical position of the cursor in inches
Display opening dialog box on startup	If selected, causes that dialog box to open when Harvard ChartXL opens
Auto recalc processed data	If selected, causes automatic processing graphs to recalculate when changes are made to source data

Default Font and Line Attributes

To set default font and line attributes for new graphs:

1. Choose **Options** from the Tools menu.
2. In the Options dialog box, select the category for the attributes that you want to set.
3. Make changes to options shown on the right side of the dialog box.
4. Select other categories and make changes as needed.
5. Click OK when you finish.

Each category is explained in the table below.

Axis labels	Numbers or words that display on the axis. You can set font attributes and alignment along the axis.
Axis lines	Lines that define the axes. You can set default width and color for lines and tick marks on the axis and define width and color of grid lines on a graph.
Axis titles	Names you can type to define what the axis represents. You can set font attributes and alignment along the axis.
Captions	Text that is added to a page. You can set font attributes and alignment of captions within a text box.
Data	Labels that are added to a graph to identify data points. You can set font attributes and alignment with respect to the data points.
General Defaults	See *General Program Defaults*.
Graph frame	The rectangle that defines the graph. You can set dimensions, line weight, line color, or fill color.
Legend	The explanation of how data is displayed in a graph. You can set font attributes and alignment of text within a legend box.

Working with Spreadsheets

Understanding Spreadsheets

The Harvard ChartXL spreadsheet is a powerful tool designed to assist you with data display and analysis. When you create a new spreadsheet in Harvard ChartXL, it becomes a data resource for the current file.

A spreadsheet that you use for a graph is automatically saved in the .HCX file where the graph is saved and opened when you open the file for the graph.

You can have as many spreadsheets as you need for a graph. After you create a spreadsheet, you can select it as the data source for any number of graphs.

Creating or Opening a Spreadsheet

New spreadsheets can be created from the Main window or the Spreadsheet window.

To create a new spreadsheet:

1. Choose **New** from the File menu.
2. Select **Spreadsheet** in the New File dialog box and click OK.

Or, click the New Spreadsheet button on the Main tool bar.

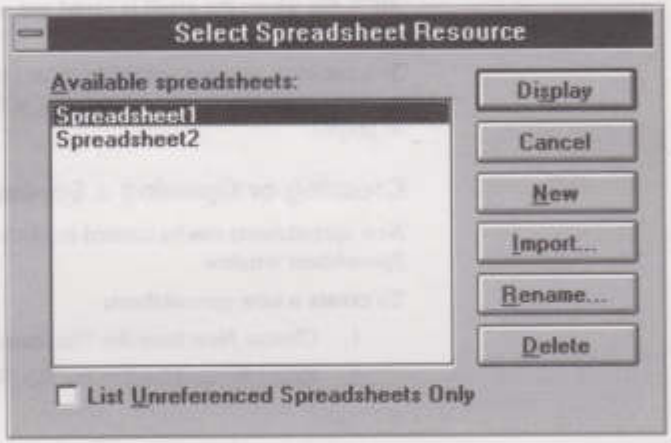
When you open a graph file, Harvard ChartXL automatically accesses all related spreadsheet resources. Spreadsheets with linked data are also updated when you open a file.

To open an existing spreadsheet, use any of these methods:

- Choose **Spreadsheet** from the View menu
- Select a graph or a data set. Click the right mouse button to open the context-sensitive menu for the graph, and choose **Spreadsheet**.
- Click the View Spreadsheet button on the Main tool bar

If a graph or a data set is selected, the spreadsheet for that graph automatically opens.

If a graph or data set is not selected, the Select Spreadsheet Resource dialog box opens. Any spreadsheets created or saved with the current file are listed. Select the spreadsheet you want to open and click Display.



Saving a Spreadsheet

Any spreadsheet, whether created or imported into Harvard ChartXL, can be saved. Spreadsheets are saved in Harvard ChartXL ASCII format, space delimited ASCII with a header indicating the number of rows and columns to be used, (for example, 5 20 indicates that there will be 5 rows and 20 columns of data in the spreadsheet). Harvard ChartXL spreadsheets are saved with a .DAT file extension.

Save Data and Save Data As Commands

The Save Data command can only be used for .DIL spreadsheets that were originally imported as .DAT files. The Save Data As command is used for saving most spreadsheets. Both commands are located in the File menu, from either the Main or Spreadsheet window.

To save (export) an open spreadsheet as an external ASCII file:

Choose **Save Data As** from the File menu. Select the drive and directory in the Save As dialog box where you want to save the data. Type a file name. It is not necessary to specify a file extension. Harvard ChartXL will automatically assign a .DAT extension. Click OK to save the file.

Note: If you imported a .DAT file and maintained the link, you can use **Save Data** from the File menu to save changes you made to the spreadsheet. This updates the source file using the same name and directory information.

To save (export) a spreadsheet as an external ASCII file from the Main window:

Spreadsheets can be saved from the Main window; you do not have to view a spreadsheet in order to save it. Use the same procedure described above, but you must first select the graphed data that is related to the spreadsheet. The bottom left corner of the screen displays a message indicating the current selection. Use **Save Data As** or **Save Data** from the File menu to save the spreadsheet associated with the selected data.

Closing a Spreadsheet

All spreadsheet data is saved with the related file. Therefore, Harvard ChartXL prompts you to save changes when you close the Main window.

If you close a Spreadsheet window, the data remains active and available to the graphs.

To close a spreadsheet:

1. Click OK at the top right of the spreadsheet.
2. Or, choose **Close** from the File menu.

Renaming a Spreadsheet

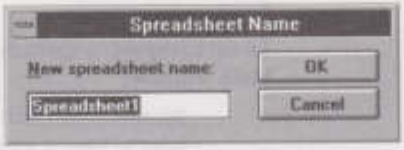
When you create a new spreadsheet, it is named Spreadsheet(n). The (n) represents the number of unnamed spreadsheets you have created. When you import a spreadsheet into Harvard ChartXL, it retains its original name. The drive and directory where the file exists are added to the name.

When you use one of the automatic processing graphs or graph a formula, a new spreadsheet is automatically created and given a default name.

Harvard ChartXL allows you to change the name of any spreadsheet. This changes the name displayed in Harvard ChartXL, not the file name saved on your disk.

To change a spreadsheet name:

1. If you are currently viewing a spreadsheet, click the Open Spreadsheet button on the Main tool bar or choose **Spreadsheet** from the View Menu. Select the spreadsheet you want to rename from the Select Spreadsheet Resource dialog box. Click Rename. Type a new name in the Spreadsheet Name dialog box and click OK. This new name appears in the Select Spreadsheet Resource dialog box, and in the display bar at the top of the open spreadsheet. This name is saved within the active file.



2. Or, if you do not have an open spreadsheet, you must make sure none of the data on any of the graphs is selected. If any graphed data is selected, the associated spreadsheet opens, rather than the Select Spreadsheet Resource dialog box. The currently selected object is indicated at the lower left corner of your screen. If it says "Edit (anything)," you need to first deselect the object by clicking on a blank portion of your screen. When you are sure nothing is selected, click the Open Spreadsheet button to access the Select Spreadsheet Resource dialog box and follow the instructions above.

Deleting a Spreadsheet

You may want to delete spreadsheets you no longer need or use. Deleting a spreadsheet removes the reference to the spreadsheet within Harvard ChartXL. It does not remove any data files that are saved on disk. Spreadsheets "associated" with a graph (or plotted on a graph) displayed in a window cannot be deleted.

To delete a spreadsheet:

1. Choose **Spreadsheet** from the View menu to open the Select Spreadsheet Resource dialog box. Select the name of the spreadsheet you want to delete and click Delete. Click Yes to delete the spreadsheet from the current file.
2. Or, click the View Spreadsheet button to open the Select Spreadsheet Resource dialog box. Select the name of the spreadsheet you want to delete and click Delete. Click OK to delete the spreadsheet from the current file.

Note: If a spreadsheet opens, rather than the Select Spreadsheet Resource dialog box, it means a data set is selected on a graph. Click OK to close the spreadsheet. Click a blank part of the screen, and choose **Spreadsheet** from the View menu, or click the View Spreadsheet button to access the correct dialog box. If the message "Cannot delete spreadsheet with open references" appears, the spreadsheet you are trying to delete is open or associated with a graph.

Entering Data from the Keyboard

This section explains how to type data into a spreadsheet and edit data that is already there.

To enter data moving down a column:

Click to select the first cell in the column you want to fill. Type the first entry. Use the Down Arrow key on your keyboard to accept the entry and move to the next cell in the column.

To enter data moving across a row:

Click the first cell in the row you want to fill. Type the first entry. Press the Enter key to accept the entry, or click the green checkmark above the Spreadsheet window (next to the cell entry display area). Use the Right Arrow key on your keyboard to move to the next cell in the row.

Using Data from Other Applications

This section explains how to import and export data and how to use Harvard ChartXL's linking features.

Linking Data Using DDE

Harvard ChartXL can link data in spreadsheet cells with data in other Windows applications using Dynamic Data Exchange (DDE). Once the link is established, the data in both programs is dynamically synchronized. For example, you may have an Excel spreadsheet with two columns of data you want to graph using Harvard ChartXL. As the Excel data is updated, the data (and associated graph) in Harvard ChartXL is updated at the same time. To set up a DDE link, open your Excel spreadsheet, and open your Harvard ChartXL file containing the graph. Position the Excel window and the Harvard ChartXL window so that you can view them both. Change the numbers in Excel and watch your graph change accordingly.

Note: In order for a DDE link to exist, both programs must be open. You cannot have a DDE link if you close one of the programs.

Setting Up a DDE Link

Open your Harvard ChartXL file and the program and file that you want to link to. In the other program, select and copy the data you want to link. Switch to Harvard ChartXL. Click a cell in the spreadsheet you want to link to. Choose **Paste Link** from the Edit menu. The origin of the data displays above the Harvard ChartXL Spreadsheet window in the display area. The data can be graphed, and both the graph and the spreadsheet change to reflect any changes made in the linked program. When you save the file, the link information is stored in the same file.

Reestablishing a DDE Link

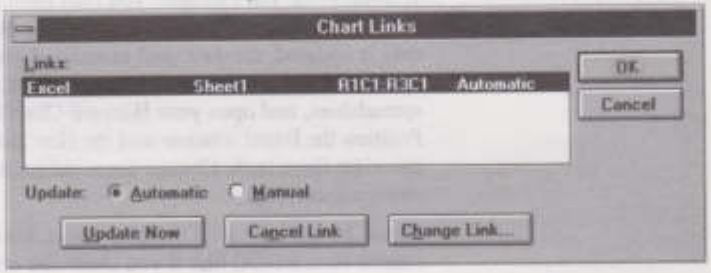
When you try to open a Harvard ChartXL file that contains a DDE link, one of two things happen:

1. If both the program and the file containing the linked data are open, Harvard ChartXL automatically reestablishes the link.
2. If the program is not open, or the file is not open, Harvard ChartXL tries to reestablish the link. Dialogs give you the opportunity to open the file without leaving Harvard ChartXL.

Note: If you choose not to reestablish a DDE link or if you cancel a DDE link, your data remains in the spreadsheet. A copy of your data is stored in the file, and your graph and spreadsheet exist even though the original data is not linked or has been deleted.

Canceling a DDE Link

1. Open the Harvard ChartXL spreadsheet that contains the DDE link. Click the cell where the link was originally pasted. Choose **Clear Link** from the Edit menu.
2. Or, open the Harvard ChartXL file that contains the DDE link. Choose **Links** from the Edit menu. Existing links for the current file are listed in the Chart Links dialog box. Select the link you want to cancel and click Cancel Link. The link is canceled, but its values remain.



Links are set to update automatically by default. You can click Manual if you don't want the Harvard ChartXL spreadsheet to update while you change your linked data file.

Note: The spreadsheet that contains the link need not be open to access the Chart Links dialog box. This dialog box is available from both the Main and Spreadsheet windows in the Edit menu.

Importing Data Files

This section explains how to import data, update imported data, and how to change and cancel a link.

Harvard ChartXL can import data files in the following formats:

DAT	Harvard ChartXL ASCII
TXT	Raw ASCII
DIF	Generic spreadsheet format
WK3	Lotus 1-2-3 version 4.0 and earlier
XLS	Excel version 4.0 and earlier

Importing Data Without a Link

You can import data into your Harvard ChartXL spreadsheet without establishing a permanent link.

To import unlinked data into a Harvard ChartXL spreadsheet:

Choose **Spreadsheet** from the View menu or click the View Spreadsheet button. Click Import in the Select Spreadsheet Resource dialog box. Select the file you want to import in the Open dialog box and click OK. A dialog box appears indicating that the file was imported correctly and asking if you want to maintain a permanent link. Click No to complete the import of an unlinked spreadsheet.

Importing Data Using a DIL Link

Dynamic Import Link (DIL) is a special type of link available in Harvard ChartXL. When you import a data file, you are prompted as to whether or not you want to maintain a permanent link. When you open a file that contains DIL spreadsheets, Harvard ChartXL reads the source file and updates your graphs and spreadsheets with any changes. Your Harvard ChartXL files always contain the latest data. This is not a live link, so the data is updated when you open an existing file containing links, or when you use the Links command to force an update.

Note: You cannot have a DIL link and a DDE link in the same spreadsheet.

To import DIL linked data into a spreadsheet:

Choose **Spreadsheet** from the View menu or click the View Spreadsheet button. Click Import in the Select Spreadsheet Resource dialog box. Select the file you want to import in the Open dialog box and click OK. A dialog box appears indicating that the file was imported correctly and asking if you want to maintain a permanent link. Click Yes to complete the import of a DIL linked spreadsheet. When you save the file, the link information is stored with it. The next time you open the file, Harvard ChartXL reimports the data. The spreadsheet matches your original data file.

Updating a Spreadsheet with a DIL Link

When you import a file and maintain the permanent link, you are telling Harvard ChartXL to reimport the data file each time you open the file containing the link.

To update a DIL linked spreadsheet:

Choose **Links** from the Edit menu. The Chart Links dialog box displays the links in the current file. Select the file you want to update and click Update Now. Changes to the selected data file are displayed in the Harvard ChartXL spreadsheet and on any associated graphs.

Changing the Data File for a Graph with a DIL Link

If you create a graph from a DIL spreadsheet, you can keep the graph formatting and change the data file that it is linked to. This is one way to retain a graph format without recreating the graph with new data.

To change a DIL data file:

Choose **Links** from the Edit menu. The Chart Links dialog box displays the links in the current file. Select the file you want to change and click Change Link. The Change Link dialog box is identical to the Open dialog box. Select the new data file you want to use and click OK to import it. The old data is replaced with the new data and applied to any associated graphs.

Canceling a DIL Link

When you no longer need to import the data from another file each time you open your Harvard ChartXL file, you can cancel the link.

To cancel a DIL link:

1. Choose **Links** from the Edit menu. The Chart Links dialog box displays the links in the current file. Select the file you want to cancel and click Cancel Link. The link is canceled, and the data in the spreadsheet is stored within the current file when you save it.
2. Or, open the spreadsheet that contains the DIL data. Click cell A1 (this is the "anchor cell" or the cell where the link information is stored). Choose **Clear Link** from the Edit menu. The link is canceled and the data in the spreadsheet is stored within the current file when you save it.

Notes: When you cancel a DIL link (or if Harvard ChartXL can't locate the original data file), you have not lost your data. A copy of every spreadsheet is stored within the file so your data is always available to you.

You cannot insert, delete, or transpose columns or rows in a DIL spreadsheet because the structure of the spreadsheet in Harvard ChartXL must be identical to the structure of the linked file. You can add tables to a DIL spreadsheet.

Changing Data That Was Imported Using DIL

If you have a DIL linked spreadsheet, and you made changes to the spreadsheet in Harvard ChartXL, the changed cells are "tagged." A tagged cell is colored gray, even if you applied a fill to that cell. A tagged cell indicates that it contains a value that is different than the original data file. Since a DIL linked spreadsheet is reimported every time you open the file, it is important to know there are differences between the file that is being imported and the spreadsheet that is being displayed. This allows you to make changes to the spreadsheet in Harvard ChartXL without changing your original data file. The value displayed in the tagged cell is the value used for formulas and graphs. The original data value is stored in the spreadsheet and can be obtained by selecting a tagged cell and choosing **Clear Tag** from the Edit menu.

Exporting Data Files

Although spreadsheets created or imported into a file are saved with that file, you may want to export the data to another Windows application, or another Harvard ChartXL file. Data files are exported from Harvard ChartXL as space delimited ASCII text with a header at the beginning of the file to indicate the number of columns and rows. This header is used by Harvard ChartXL to determine the layout of the spreadsheet. If you have multiple tables, a new header appears in the data file where each table begins. Below you will find a sample spreadsheet and the ASCII file that was created when the spreadsheet was exported.

T1	A	B	C	D
1		Monday	Tuesday	Wednesday
2	1	2	2	5
3	2	8	5	8
4	3	6	6	6
5	4	7	8	5
6	5	2	2	7
7				

This spreadsheet produced this ASCII text:

6 4

NaN "Monday" "Tuesday" "Wednesday"

1 2 2 5

2 8 5 8

3 6 6 6

4 7 8 5

5 2 2 7

Notice that the labels are in quotation marks and that cell A1 (which is blank) is marked with the symbol NaN. The 6 and 4 at the beginning of the file indicate that the data is displayed in four columns of six rows each.

To export spreadsheet data:

Select the spreadsheet you want to export. This can be done by opening the spreadsheet or, if the data is graphed, by selecting the data set on the graph that is associated with the spreadsheet. Choose **Save Data As** from the File menu. Select a location and file name in the Save As dialog box. Click OK to export the data file. If you are exporting a spreadsheet that was imported as a .DAT file, you can use **Save Data** from the File menu to save changes without changing the name or location of the file.

Using Tables in a Spreadsheet

This section explains the concept of tables in a spreadsheet and how to use them to make your work easier.

Understanding Tables

A single Harvard ChartXL spreadsheet can contain up to 255 tables. A table can be described as a spreadsheet within a spreadsheet. Each table contains the same number of addressable cells as a standard spreadsheet.

Data organization and referencing are simplified by keeping data at the same location in different tables. Data which you might otherwise keep in separate spreadsheets can be within a single spreadsheet. For example, suppose you created thirteen tables within a single spreadsheet. The first table could contain financial results for the year, while the remaining twelve tables contain the supporting monthly results.

Tables can reference each other. Formulas can be written across tables, and graphs can be plotted across tables.

New spreadsheets have one table. T1 is the default name. You can add tables, change the name of existing tables, and delete tables. Automatic processing graphs and some equations in the Formula Solver automatically create spreadsheets with multiple tables.

Inserting a Table

There are several ways to add a table to an existing spreadsheet.

To insert tables into an open spreadsheet:

1. Choose **New Table** from the Edit menu or click the right mouse button and choose New Table. A new table is inserted after the last existing table.
2. Or, click the New Table button at the top right side of the spreadsheet. A new table is inserted after the last existing table.

3. Or, choose **Insert** from the Edit menu. Select Insert Table and click OK on the Insert dialog box. A new table is inserted before the currently selected table.

Renaming a Table

Every Harvard ChartXL spreadsheet consists of at least one table, but can contain a maximum of 255 tables. Spreadsheet tables are given default names, but you may assign names that apply to your data.

To rename a spreadsheet table:

To change the name of a spreadsheet table, you must view the spreadsheet. Select the table you want to rename from the file tabs located at the top of the spreadsheet. When you are viewing the table you want to rename, choose **Table Name** from the Format menu or use the right mouse button to click a spreadsheet tab and choose Table Name. Type the new name and click OK in the Table Name dialog box. If you want to return to the default name, click Default Table Name and click OK.

Moving Between Tables

One table at a time can be displayed in a single spreadsheet. You can choose which table to view and switch tables at any time.

Choosing a Table to View

1. Open the spreadsheet that contains the table you want to view. The first table in the spreadsheet is displayed. Click the tab at the top of the spreadsheet that represents the table you want to view.
2. Or, open the spreadsheet that contains the table you want to view. Use the left and right arrow buttons at the top right of the spreadsheet to scroll between the tables.
3. Or, open the spreadsheet that contains the table you want to view. Choose **Change Table** from the Edit menu. Type the table number and click OK in the Change Table dialog box. The tables are identified by number in this dialog box, even if you have renamed them.

Deleting a Table

You may want to delete a table you no longer need or use. If you delete a table that is attached to a graph, the plotted data is removed from the graph. Deleting a table does not remove any data files that are saved on disk.

1. Open the spreadsheet and locate the table you want to delete. Choose **Delete** from the Edit menu. Click Delete Table and click OK in the Delete dialog box.

2. Or, open the spreadsheet that contains the table you want to delete. Click the table number located in the upper left of the spreadsheet, between the A for the first column and the 1 for the first row. With the table selected, choose **Delete** from the Edit menu.

Setting and Viewing Graph Ranges

Each graph type has a unique set of variables that can be assigned to different portions of your graph. Harvard ChartXL allows you to select ranges from the spreadsheet to apply to the variables needed for the selected graph type.

The Range Highlighter

The Range Highlighter displays the currently selected ranges and allows you to define the ranges that you want to use on your graph. The selections in the Range Highlighter are duplicates of the selections found at the bottom of the Graph menu.

Each graph type has default ranges assigned to it. You can use the default ranges, or define your own. The variables that can be defined are displayed in the Range Highlighter and at the bottom of the Graph menu. This section explains how to define ranges.

Viewing the Current Graph Ranges

Harvard ChartXL default ranges are set to match the most common data layout for that graph type. You can change the ranges using the Range Highlighter. If you open a spreadsheet that is attached to a graph, the Range Highlighter automatically opens. The only exception is the input spreadsheet for an automatic processing graph. These graphs have set ranges that are used to process the data in the input spreadsheet. You cannot change these processing ranges from within the spreadsheet view. There is a Range Highlighter available for the output spreadsheet which contains the processed data.

Note: If you open a spreadsheet attached to a graph with multiple data sets, or to multiple graphs, and you do not have a data set selected before opening the spreadsheet, the Range Highlighter is not active. To activate the Range Highlighter for data sets from the same spreadsheet, choose **Range Association** from the Graph menu. A list of the data sets that are currently attached to the open spreadsheet appears. The type of data is identified, and the data sets are listed in the order in which they were created. A check mark appears next to the current data set. Click any of the listed data sets to activate the Range Highlighter for that set.

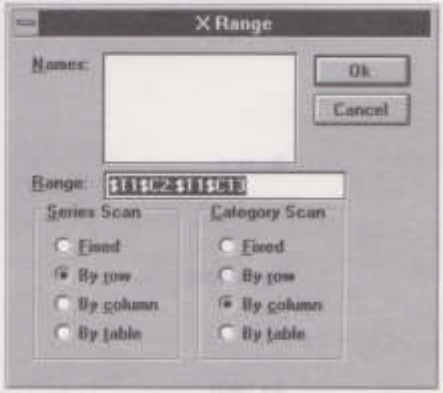
To view the assigned graph ranges:

1. Open the spreadsheet attached to the graph you want to see the ranges for. Click the graph range name in the Range Highlighter. The range that is currently set to represent that graph is highlighted in the spreadsheet and the range address appears in the Range Highlighter display area.

   For example, if you want to check the range for X in an XY plot, click X in the Range Highlighter. The range of cells currently defined as X appears highlighted in the spreadsheet, and the range address is displayed in the Range Highlighter display area.

2. Or, open the spreadsheet attached to the graph you want to see the ranges for. Open the Graph menu. At the bottom of this menu, there is a list of graph ranges that are identical to those displayed in the Range Highlighter. Select the graph range name.

   For example, if you want to check the range for X in an XY plot, choose X at the bottom of the Graph menu. The range address for the selected graph range name appears in the Range display area of the dialog box. If a variable name was used to define the range, it appears highlighted in the Names box.



Names	Displays variable names that exist in the spreadsheet.
Range	Displays the currently selected range address. The range can be changed by clicking a different variable name, or by typing a new range address. If a range is highlighted in the spreadsheet before accessing this dialog box, that range address is displayed.
Series Scan	Displays the primary direction for scanning the selected range for a graph.
Category Scan	Displays the secondary direction for scanning the selected range for a graph. This option applies if multiple columns, rows, or tables are defined as the range.

Note: The Series Scan option defines how each series of data in a selected range is read. The Category Scan option defines where the next series starts when the end of a series is reached. Each of these options can be applied to any of the choices available in the Graph menu.

For example: Suppose column A contains X data and columns B and C contain Y data. You want each entry in column A plotted against each entry in column B, and then each entry in column C, resulting in two XY curves. You set the Series Scan for X to **By row**. This sets X to be read from each cell in column A, moving down one row for each new data point. The Category Scan does not apply because there is a single column of X. The Series Scan for Y is also set to **By row**. This sets Y to be read from each cell in column B, moving down one row for each new data point. The Category Scan is set to **By column**. This means the next series begins in column C after the last entry in column B.

Fixed	Sets the data to be read from the first column, row, or table when multiple columns, rows, or tables are selected. The highlight color for the Fixed option is light green.
By row	Sets the data to be scanned by row number, or down a selected column. The highlight color for the By row option is yellow.
By column	Sets the data to be scanned by column letter or across a selected row. The highlight color for the By column option is light blue.
By table	Sets the data to be scanned by table number across a selection of tables. The highlight color for the By table option is magenta.

Note: Selecting a direction to scan affects highlight color in the spreadsheet. When you click a graph range name in the Range Highlighter, the currently defined range for that range name is highlighted in the spreadsheet. Refer to the section above for colors assigned to different directions. If you select a range in the spreadsheet that is also selected in the Range Highlighter, the first cell in that range has the assigned color. The other cells appear in an opposing color. If you select a range in the spreadsheet that is not selected in the Range Highlighter, the first cell in the range appears white with a thick border, and the other cells are highlighted in black.

Setting the Graph Ranges

When you create a graph, Harvard ChartXL assumes the data in the supporting spreadsheet is in specific locations within the spreadsheet. You can change the defaults assigned to the graph if your data is not in the default range or if you want to plot a different portion of the spreadsheet. Change the range by choosing one of the graph range names at the bottom of the Graph menu or in the Range Highlighter.

Note: When you choose **Default Ranges** from the Graph menu, the default data range is reassigned to the graph. This means Harvard ChartXL returns to the default locations in your spreadsheet for the data supporting the graph.

To change the graph ranges:

1. Click the graph range name in the Range Highlighter. The range currently set is highlighted. Define the new range in any of the following ways:
   - Drag to select a new range.
   - Click in the display area in the Range Highlighter and type a range address.
   - Click in the display area in the Range Highlighter and type a variable name.

   Click Set to change the graph range. Do this for each graph range name you want to define. In most cases, it is not necessary to define every graph range name listed in the Range Highlighter.
2. Or, open the Graph menu and choose the graph range name that represents the graph range you want to change. Graph range name dialog boxs are identical, except the name displayed at the top of the dialog. Define the new range in any of the following ways:
   - Select a range before choosing the graph range name from the Graph menu.
   - Click in the Range display area of the Graph range name dialog and type a range address.
   - Click a variable name in the Names area of the Graph range name dialog.

Click OK to change the graph range. Do this for each graph range name you want to define. In most cases, it is not necessary to define every graph range name listed in the Range Highlighter.

Editing Spreadsheet Data

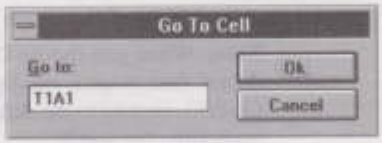
This section explains how to locate, select, edit, and transpose data in your spreadsheets.

Moving to a Specific Cell or Table

You can easily move to any cell in the spreadsheet by using the mouse or keyboard.

To move to a specific cell in a table:

Press the F5 key. Type the table number and cell address in the Go To Cell dialog. Click OK.



Moving with the Keyboard

To move:	Press:
Up, down, left, right	Arrow keys
Up or down one window	PAGE UP or PAGE DOWN
To the beginning of the row	HOME
Left or right one page	TAB or SHIFT + TAB
To Cell A1	CTRL + HOME
To last cell in spreadsheet	CTRL + END

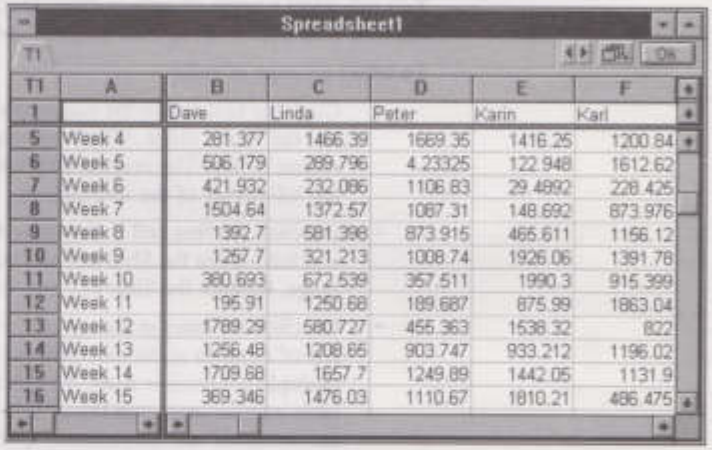
To move to a different table:

1. Click the tab at the top of the spreadsheet for the table you want to view. Or, click the left and right arrow buttons at the top right of the spreadsheet.
2. Or, choose **Change Table** from the Edit menu. Type the table number in the Change Table dialog box and click OK.

Note: Cell addresses are based on the Column letter and Row number for that cell. Column letters are across the top of the spreadsheet. Row numbers are down the left side of the spreadsheet. Each table is given a number that is located between the first column label and the first row label.

Using the Split-Screen Option

The Harvard ChartXL spreadsheet can be viewed in split-pane view. This is helpful if you want to view labels in the first column or row while working with other parts of the spreadsheet. The Harvard ChartXL spreadsheet can be split into as many as four distinct sections with one section active at a time. When in split-pane view, the non-active area is static as you scroll through the spreadsheet.



T1	A	B	C	D	E	F
1		Dave	Linda	Peter	Karin	Karl
5	Week 4	281.377	1466.39	1669.35	1416.25	1200.84
6	Week 5	506.179	289.796	4.23325	122.948	1612.62
7	Week 6	421.932	232.086	1106.83	29.4992	228.425
8	Week 7	1504.64	1372.57	1067.31	148.692	873.976
9	Week 8	1392.7	581.398	873.915	465.611	1156.12
10	Week 9	1257.7	321.213	1008.74	1926.06	1391.78
11	Week 10	360.693	672.539	357.511	1990.3	915.399
12	Week 11	195.91	1250.68	189.687	875.99	1863.04
13	Week 12	1789.29	580.727	455.363	1538.32	822
14	Week 13	1256.48	1208.66	903.747	933.212	1196.02
15	Week 14	1709.68	1657.7	1249.89	1442.05	1131.9
16	Week 15	369.346	1476.03	1110.67	1810.21	486.475

Splits are indicated by the heavy lines. In this example, labels in the first row and column are fixed. Thirteen rows are displayed even though the data in the spreadsheet covers fifty-two rows. The first row remains fixed in place, as you scroll through the spreadsheet.

To split a spreadsheet:

Two split-bar tabs are located on the Spreadsheet window. The one at the lower left splits the spreadsheet by columns. The one at the right splits the spreadsheet by rows. The cursor changes to a bar with arrows as it moves over the split bars. Use this cursor to drag the split bar to the end of the area you want to remain fixed. Double-click the split-bar tab to reset the bar, or drag the bar back to the initial location.

Selecting Cells and Ranges

You can easily select a cell or a range of cells in the spreadsheet by using the mouse or keyboard.

Selecting a Single Cell

A cell must be selected before you can enter or edit its contents. The address of the currently selected cell is displayed at the top left corner of the spreadsheet.

A single cell can be selected by clicking it, or by using the arrow keys on your keyboard. If you are selecting a single cell to use in a formula, variable, or graph, type the cell address in the appropriate dialog box.

Selecting a Range of Cells

You can select a range of cells to copy, graph, or use in a formula. Harvard ChartXL offers several methods for selecting a range of cells.

To select a range of cells:

- Click the first cell in the range you want to select and drag to the last cell in the range. When the range is highlighted, release the mouse button. The column and row numbers are displayed at the top left corner of the spreadsheet.
- Or, click the first cell in the range that you want to select. Press and hold down the Shift key as you click the last cell in the range. Release the Shift key and the range is selected.
- Or, click the letter at the top of a column or the number at the left of a row to select that entire column or row. Drag to select multiple columns or rows. To select an entire table, click the table number at the top left of the spreadsheet between the first column label and the first row label. Although the entire column, row, or table appears selected, only the cells that contain data are selected.
- Or, if you are selecting a range of cells to use in a formula, variable, or graph, type the range address in the appropriate dialog box.
- Or, if a variable already exists, and you are creating a formula or graph, type the variable name in the appropriate dialog box.

Note: Harvard ChartXL allows you to assign variable names to cells or a ranges of cells. Using variable names, instead of cell addresses, makes it easier to keep track of the data.

Copying, Deleting, and Pasting Cell Contents

Data in cells or ranges of cells can be moved or copied into other cells, ranges, spreadsheets, or Windows programs. Cut, Copy, and Paste commands are available in the Spreadsheet window.

Note: Cut, Copy, Paste, and Clear commands can be accessed in a context-sensitive menu. To access this menu, select a cell or cell range and click the right mouse button. This special menu is available to any selected object in Harvard ChartXL, and is designed to give you quick access to the formatting options available for the selected object.

Copying Cells, Cell Ranges, or Formulas

Select a cell or cell range. Choose **Copy** from the Edit menu or click the Copy button on the Main tool bar. A copy of the selection is placed in the Windows clipboard where it is available to other applications or spreadsheets. If the cell or range contains a formula, the formula is also copied.

Cutting Cells, Cell Ranges, or Formulas

Select a cell or cell range. Choose **Cut** from the Edit menu or click the Cut button on the Main tool bar. The entry in the selected cell or cell range is deleted and placed in the Windows clipboard where it is available to other applications or spreadsheets. If the cell or range contains a formula, the formula is also deleted.

Pasting Cells, Cell Ranges, or Formulas

Data that is in the Windows clipboard can be pasted into a Harvard ChartXL spreadsheet or another Windows program. This includes cell entries and text that is cut or copied into the clipboard from any Windows application.

To paste data from the clipboard:

Select the cell you want the data pasted into. If the data in the spreadsheet is from a range of cells, select the cell where you want the range to start. Choose **Paste** from the Edit menu or click the Paste button on the Main tool bar. The data in the clipboard is placed in the spreadsheet. If the data in the clipboard contains a formula, the formula is also pasted.

Note: If you are copying, cutting and pasting formulas, how the formula reacts in the new location depends on how the formula is written. Formulas using fixed cell addresses remain the same. Formulas using relative cell addresses change depending on their location in the spreadsheet. For a full discussion of formulas, see **Working with Formulas**.

Deleting Cells, Cell Ranges, or Formulas

Select a cell or cell range. Choose **Clear** from the Edit menu or press Delete on your keyboard. The entry in the selected cell or cell range is deleted. If the cell or range contains a formula, the formula is also deleted. Deleted entries are not in the clipboard and cannot be pasted.

Undoing Cut, Copy, Paste, or Clear

Use the Undo command to reverse the last Copy, Cut, Paste, or Clear commands. The Undo command works on the last action taken. Choose **Undo** from the Edit menu or click the Undo button on the Main tool bar.

Transposing Data

The data in a spreadsheet can be transposed, which means the data in columns is switched to rows and the data in rows is switched to columns. Your data is not affected because the association between the columns and rows remains the same. You can transpose entire tables or selected ranges in a table. Ranges must be square to maintain column/row integrity, and there must be room for the new arrangement of the data.

To transpose an entire table:

Select a cell in the table you want to transpose. Choose **Transpose** from the Edit menu. Click Transpose Table in the Transpose dialog box and click OK.

To transpose a range of cells:

Select the first cell in the range you want to transpose and drag to select the range. (Remember, the range must be square.) Choose **Transpose** from the Edit menu. Click Transpose Range in the Transpose dialog box and click OK.

Formatting a Spreadsheet

This section explains how to format and print spreadsheets. Formatting the spreadsheet does not affect any associated graphs.

Inserting and Deleting Columns and Rows

An existing spreadsheet can be modified by inserting or deleting columns or rows.

Inserting Columns and Rows

Columns and rows can be inserted in your spreadsheets. If you import a spreadsheet and maintain the permanent (DIL) link, you cannot insert columns or rows because the structure of the original spreadsheet must be maintained.

To insert a new column in an existing spreadsheet:

1. Select a cell in the column you want to move to the right. Choose **Insert** from the Edit menu. Click Insert Column and click OK in the Insert dialog box. The new column is inserted before the current column.

2. Or, select the column you want to move to the right by clicking on the letter at the top of the column. Choose **Insert** from the Edit menu or click the right mouse button and choose Insert Column. A new column is inserted before the selected column.

To insert a new row in an existing spreadsheet:

1. Select a cell in the row you want to move down. Choose **Insert** from the Edit menu. Click Insert Row and click OK in the Insert dialog box. The new row is inserted before the current row.
2. Or, select the row you want to move down by clicking on the number to the left of the row. Choose **Insert** from the Edit menu or click the right mouse button and choose Insert Row. A new row is inserted before the selected row.

Deleting Columns and Rows

Selected columns and rows in spreadsheets can be deleted. The column or row and any data or formulas are deleted. If you import a spreadsheet and maintain the permanent (DIL) link, you cannot delete columns or rows because the structure of the original spreadsheet must be maintained.

To delete a column or several columns:

1. Open the spreadsheet that contains the column(s) you want to delete. Click any cell in the column and choose **Delete** from the Edit menu. Select Delete Column in the Delete dialog box and click OK. If you want to delete multiple columns, click a cell in the first column and drag to select the same cell number in as many columns as you want. When you choose **Delete** from the Edit menu, the selected columns are deleted.
2. Or, open the spreadsheet that contains the column(s) you want to delete. Click the letter at the top of the column. Choose **Delete** from the Edit menu. The selected column is deleted. To select multiple columns, click any letter and drag to select as many columns as you want. When you choose **Delete** from the Edit menu, the selected columns are deleted.

To delete a row or several rows:

1. Open the spreadsheet that contains the row(s) you want to delete. Click any cell in the row and choose **Delete** from the Edit menu. Select Delete Row in the Delete dialog box and click OK. If you want to delete multiple rows, click a cell in the first row and drag to select the same cell letter in as many rows as you want. When you choose **Delete** from the Edit menu, the selected rows are deleted.
2. Or, open the spreadsheet that contains the row(s) you want to delete. Click the number to the left of the row and choose **Delete** from the Edit menu. To select multiple rows, click any row number and drag to select as many rows as you want. When you choose **Delete** from the Edit menu, the selected rows are deleted.

Changing Column Width and Row Height

Harvard ChartXL allows you to customize the width of columns and the height of rows in your spreadsheets.

Changing Column Width

Columns in a new spreadsheet or table are set to a standard width. You can adjust the column width to suit your needs. The width can be changed for one column or multiple columns.

To change the width of a single column:

1. Click any cell in the column you want to change. Choose **Column Width** from the Format menu. Type the new width, in inches, in the Column Width dialog box and click OK.

2. Or, drag to select the letters at the top of the columns. The cursor changes to a line with left and right arrows when it is near one of the dividing lines between the columns. Use this cursor to drag the column to a new size. Release the mouse button when the column is the width you want. The column to the left of the dividing line changes. As you adjust the width, the size is displayed at the top left corner of the spreadsheet.

To change the width of multiple columns:

1. Click a cell in the first column you want to change and drag to select the same cell in as many columns as you want. Choose **Column Width** from the Format menu. Type the new width, in inches, in the Column Width dialog box and click OK. The selected columns change to the same width.
2. Or, click the letter at the top of the first column you want to change and drag to select as many columns as you want. Choose **Column Width** from the Format menu or click the right mouse button and choose Column Width. Type the new column width, in inches, in the Column Width dialog box and click OK. The selected columns change to the same width.
3. Or, click the table number located at the top left side of the spreadsheet, between the first column letter and the first row number. With the table selected, choose **Column Width** from the Format menu. Type the new column width, in inches, in the Column Width dialog box and click OK. The columns in the table change to the same size.

Note: To set column width back to the default values, click the Default Column Width box in the Column Width dialog box.

Changing Row Height

Rows in a new spreadsheet or table are set to a standard height. You can adjust the row height to suit your needs. The row height automatically adjusts to the size of your text. This option can be turned off so that you can manually adjust the row height.

To change the height of a single row:

1. Click any cell in the row you want to change. Choose **Row Height** from the Format menu. Type the new height, in points, in the Row Height dialog box and click OK.

2. Or, drag to select the numbers to the left of the rows. The cursor changes to a line with up and down arrows when it is near one of the dividing lines between the rows. Use this cursor to drag the row to a new size. Release the mouse button when the row is the height you want. As you adjust the height, the size is displayed at the top left corner of the spreadsheet. The row above the dividing line changes.

To change the height of multiple rows:

1. Click a cell in the first row you want to change and drag to select the same cell in as many rows as you want. Choose **Row Height** from the Format menu. Type the new height, in points, in the Row Height dialog box and click OK. The selected rows change to the same height.
2. Or, click the number to the left of the first row you want to change and drag to select as many rows as you want. Choose **Row Height** from the Format menu or click the right mouse button and choose Row Height. Type the new row height, in points, in the Row Height dialog box and click OK. The selected rows change to the same height.
3. Or, click the table number located at the top left side of the spreadsheet, between the first column letter and the first row number. With the table selected, choose **Row Height** from the Format menu. Type the new row height, in points, in the Row Height dialog box and click OK. All the rows in the table change to the same size.

Note: To set row height back to automatic, click the Automatic Row Height box in the Row Height dialog box. Automatic sets the row height to accommodate the largest text size in the row.

Aligning Data in Cells

Entries in a cell or range of cells can be set to different alignments within the cell.

Changing the Alignment of a Single Cell

1. Click the cell that contains the entry you want to align. Choose **Alignment** from the Format menu or click the right mouse button and choose Alignment. Select the alignment you want in the Alignment dialog box and click OK.

2. Or, click the cell that contains the entry you want to align. Click the Text tab at the top of the Spreadsheet window to activate the Text Tool Bar. Click the appropriate alignment button.

Changing the Alignment of a Range of Cells

1. Click the first cell in the range and drag to select the range. Choose **Alignment** from the Format menu or click the right mouse button and choose Alignment. Select the Alignment you want in the Alignment dialog box and click OK.
2. Or, click the first cell in the range and drag to select the range. Click the Text tab at the top of the Spreadsheet window to activate the Text Tool Bar. Click the appropriate alignment button.
3. Or, click a row number or column letter to select an entire row or column. Select multiple rows or columns by dragging. Choose **Alignment** from the Format menu or click the right mouse button and choose Alignment. You can also use the alignment buttons on the Text Tool Bar to set the alignment of selected cells.

Left **Center** **Right**

Note: Options for aligning entries in a cell or range of cells are based on the position of the entry within the cell. Choose **Left** to align entries to the left side of the cell(s), **Right** to align entries to the right side of the cell(s) and **Center** to center entries within the cell(s). The **General** option aligns numbers to the right, and text to the left.

Choosing Font Characteristics

You can apply font and number formats to cell entries. Font and number formatting in the spreadsheet does not affect any associated graphs.

Selecting a Font Format

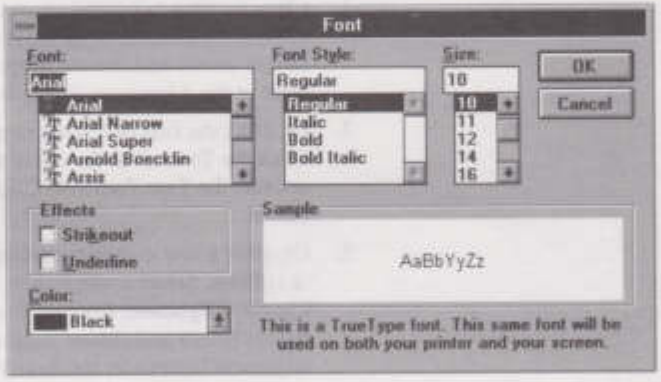
Use a font format to specify the way you want entries to appear in a single cell or a range of cells.

To select the font format for a single cell:

Click the cell you want to format. Choose **Character** from the Format menu or click the right mouse button and choose Character. Select the format you want in the Font dialog box and click OK. The font format shown in the Sample box is applied to the selected cell.

To select the font format for a range of cells:

Click the first cell in the range you want to format and drag to select the range. Choose **Character** from the Format menu or click the right mouse button and choose Character. Select the format you want in the Font dialog box and click OK. The font format shown in the Sample box is applied to the selected range of cells.



Font	Select a font name. All fonts installed on your computer are listed.
Font Style	Select a font style.
Size	Select a point size for the font.
Effects	Apply Strikeout or Underline formatting to the font.
Color	Select a color for the font.
Sample	Displays a small sample of the selected font.

Formatting Numbers

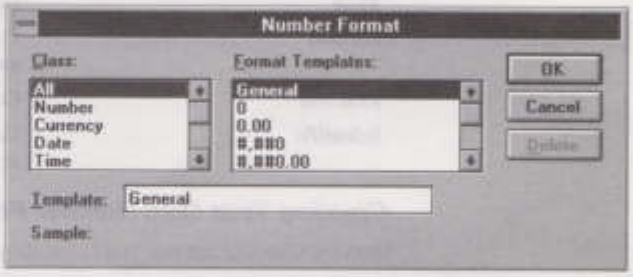
You can specify how the data in a cell or range of cells appears. The default format for Harvard ChartXL spreadsheets is General. You can set the format to display dates, times, decimals, and other standard formats.

To select the number format for a single cell:

Click the cell you want to format. Choose **Number** from the Format menu or click the right mouse button and choose Number. Select the format you want from the Number Format dialog box and click OK. The number format shown in the Sample box is applied to the selected cell.

To select the number format for a range of cells:

Click the first cell in the range you want to format and drag to select the range. Choose **Number** from the Format menu or click the right mouse button and choose Number. Select the format you want in the Number Format dialog box and click OK. The number format shown in the Sample box is applied to the selected range of cells.



Class — Select a class. The various classes are described in *Choosing the Correct Number Format*.

Format Templates — Select a format. The selected format appears in the Sample box.

Template — Create your own format templates.

Sample — Displays a sample of the selected number format.

Choosing the Correct Number Format

There are eight different classes or categories of number formats to choose from. Each class is designed to display your data in a different way. The symbols used in the format templates are described in *Number Format Codes*.

All	Displays the format templates that exist in the current file.
Number	Displays the available formats for general numbers formatting, such as decimal places and number of significant digits.
Currency	Displays the available formats for defining data as currency. The Currency class adds a $ to your data.
Date	Displays the available date formats. Numbers will be converted to dates using the Julian calendar.
Time	Displays the available time formats.
Percent	Converts selected data to percentages and adds a % character.
Fraction	Converts selected data to fractions.
Scientific	Converts selected data to scientific or exponential notation format.

Creating Your Own Number Format

Harvard ChartXL allows you to create your own number formats.

To create a custom number format:

Open the Number Format dialog box. Select the class you want to use. Type your format in the Template box. If you have a data cell selected, a sample of your template appears in the Sample box. Click OK to apply a new format to the selected cell. Custom number formats are saved within the file. This format is available in both the spreadsheet and the graph, as long as you are in the active file. Refer to *Number Format Codes* for allowable codes and their usage.

To delete a custom number format:

Open the Number Format dialog box. Select the custom format template you want to delete. Click Delete.

Number Format Codes

General	Displays the number in General format.
#	Digit place holder. If the number has more digits to the right of the decimal than there are #'s to the right in the format, the number is rounded to as many decimal places as there are #'s to the right. If the number has more digits to the left of the decimal than there are #'s to the left in the format, the extra digits are displayed.
0 (zero)	Digit place holder. Follows the same rules as the # place holder, except that if the number has fewer digits than there are zeros in the format, the extra zeros are displayed. For example, if you want the number 2.5 to appear as 2.50, type #.00 for the format.
?	Digit place holder for fractions. Follows the same rules as the # place holder.
period (.)	Decimal point. Determines how many digits are displayed to the right or left of the decimal point. If the formula contains #'s to the left of the decimal point, then numbers less than one will not have a 0 before the decimal point. To avoid this, use 0 as the first place holder to the left of the decimal point.
%	Multiplies the cell entry by 100 and adds the % character.
comma (,)	Thousands separator. Separates thousands by commas if the format contains a comma surrounded by #'s or 0's.
carat (^)	Power of ten indicator. Displays the selected number as a power of ten.
E+ e+	Scientific format. If a format contains a 0 or # to the right of an E+ or e+, the number is displayed in scientific format with the E+ or e+ inserted.
$ - + / () : space	Displays that character.
****	Displays the next character in the string. The backslash is not displayed. Useful for adding the % character to an entry without multiplying the data by 100.
m	Displays the month as a number without leading zeros (1-12). If used after the h or hh symbol, the minute is displayed, rather than the month.

mm	Displays the month as a number with leading zeros (01-12). If used after the h or hh symbol, the minute is displayed, rather than the month.
mmm	Displays the month as an abbreviation (Jan-Dec).
mmmm	Displays the month as a full name (January-December).
d	Displays the day as a number without leading zeros (1-31).
dd	Displays the day as a number with leading zeros (01-31).
ddd	Displays the day as an abbreviation (Sun-Sat).
dddd	Displays the day as a full name (Sunday-Saturday).
yy or yyyy	Displays the year as a two-digit number (00-99), or as a four-digit number (1900-2100).
h or hh	Displays the hour as a number without leading zeros (0-23) or with leading zeros (00-23). If the format contains an AM or PM indicator, the hour is based on the 12-hour clock. Otherwise, the hour is based on the 24-hour clock.
m or mm	Displays the minute as a number without leading zeros (0-59) or with leading zeros (00-59). If not used after the h or hh symbol, displays the month.
s or ss	Displays the second as a number without leading zeros (0-59) or with leading zeros (00-59).
AM, am, PM or pm	Displays the hour using a 12-hour clock.
[Red]	Displays the colors in the cell in red. Any of the colors from the text color option can be used.

Using Borders, Fills, and Gridlines

The Harvard ChartXL spreadsheet can be formatted to your personal tastes. Gridlines and borders can be turned off or on, line styles can be changed, and you can add fills to any cell or range of cells.

Changing a Border

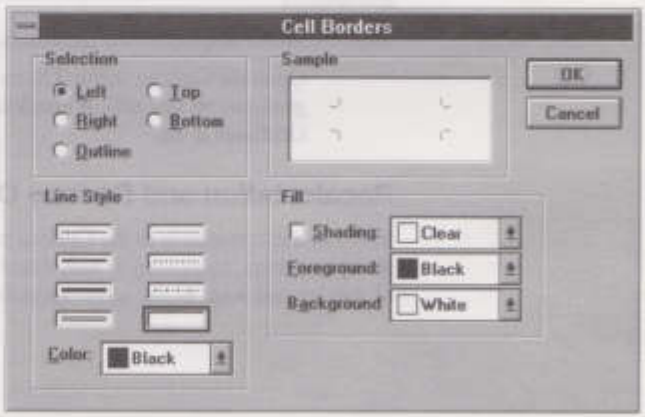
In a new spreadsheet each cell is outlined by a solid black border. You can change any part of the border.

To change the border for a single cell:

Click the cell you want to change. Choose **Border** from the Format menu or click the right mouse button and choose Border. Use the Selection section of the Cell Borders dialog box to indicate which side(s) of the cell you want to change. Use the Line Style section to select a Line Style and color for your border. The Sample box displays the current border style. Click OK to apply the border style to the selected cell.

To change the border for a range of cells:

Click the first cell in the range you want to change and drag to select the range. Choose **Border** from the Format menu or click the right mouse button and choose Border. Use the Line Style section of the Cell Borders dialog box to select a Line Style and color for your border. The Sample box displays the current border style. Click OK to apply the border style to the selected range. When you apply a border to a range of cells, the Top, Bottom, and Outline selections apply to the top, bottom, and outline of the selected range.



Changing the Fill Pattern

A fill pattern is not applied to any of the cells in a new spreadsheet. You can add a fill pattern to emphasize individual cells or a range of cells.

To apply a fill pattern to a single cell:

Click the cell you want to apply a fill pattern to. Choose **Border** from the Format menu or click the right mouse button and choose Border. Use the Fill section of the Cell Borders dialog box to select a fill pattern. You can select the colors you want in the fill, as well as the percentage of shading to apply. The Sample box displays the current fill pattern. Click OK to apply the fill pattern to the selected cell.

To apply a fill pattern to a range of cells:

Click the first cell in the range you want to change and drag to select the range. Choose **Border** from the Format menu or click the right mouse button and choose Border. Use the Line Style section of the Cell Borders dialog box to select a Line Style and color for your border. The Sample box displays the current border style. Click OK to apply the border style to the selected range. When you apply a border to a range of cells, the Top, Bottom, and Outline selections apply to the top, bottom, and outline of the selected range.

Controlling Gridlines

Default gridlines appear in a spreadsheet to divide columns and rows. Using the Borders option overrides the default gridlines. Turning off the gridlines affects the display on the screen, but not the printout of the spreadsheet.

To control the display of the gridlines:

Open the Options menu. Choose **Display Gridlines** to turn gridlines on and off. A check mark shows that Display Gridlines is on.

Recalculation and Redraw Options

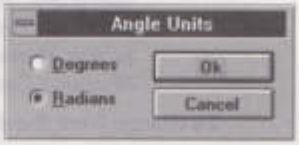
You can use commands in the Options menu to control recalculation of the spreadsheet, redrawing of associated graphs, and to choose the Units of Angles you want in the active spreadsheet.

Setting Units for Angles

The default angular units in Harvard ChartXL are in degrees. Operations involving trigonometric functions, including formulas and coordinate transformations, assume that your data is in degrees. You can choose to have the spreadsheet data interpreted as radians.

To change Angle Units:

Open the spreadsheet you want to work with. Choose **Units** from the Options menu. Click to set Degrees or Radians on or off in the Angle Units dialog box and click OK.



Controlling the Recalculation of Formulas

When Auto Recalc is on, any time you make a change in a cell that is referenced or calculated by a formula, the spreadsheet is automatically recalculated. If Auto Redraw is also on, any graph related to the current spreadsheet is updated as the spreadsheet is recalculated.

If you are making extensive changes to a spreadsheet, you may wish to turn off Auto Recalc. You can choose **Force Recalc** from the Options menu to recalculate when you want. If **Auto Redraw** from the Options menu is also selected when you choose Force Recalc, then the graph related to the current spreadsheet is also updated by the recalculation.

To turn Auto Recalc off or on:

Open the Options menu. If there is a check mark next to Auto Recalc, it is on. Choose Auto Recalc to turn it off.

Controlling the Redraw of Graphs

Auto Redraw dynamically redraws the graph as you make changes to the related spreadsheet. As you change the spreadsheet data, you can see the changes on the associated graph.

If you are making extensive changes to a spreadsheet, you may wish to turn off Auto Redraw. You can choose **Redraw Graph** from the Graph menu to update the graph when it is convenient.

To turn Auto Redraw off or on:

Open the Options menu. If there is a check mark next to Auto Redraw, it is on. Choose Auto Redraw to turn it off.

Printing a Spreadsheet

Harvard ChartXL provides several options to assist you in printing spreadsheets that meet your needs.

Choosing a Printer

To choose the default printer and printer options:

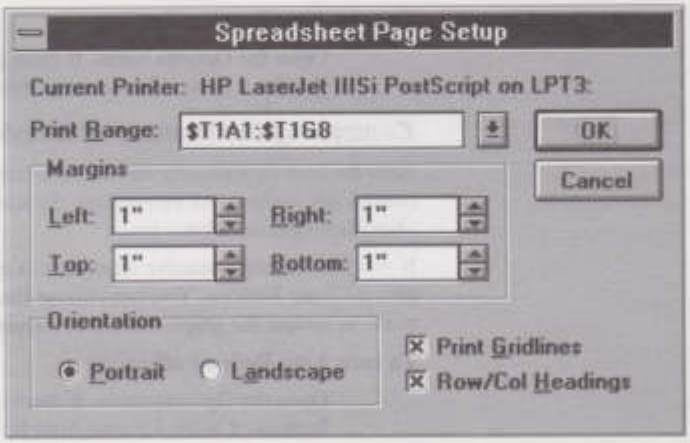
Choose **Print Setup** from the File menu. The default printer from the Windows Control Panel appears in the Print Setup dialog box. To print to the default printer, click the button next to Default Printer. Click OK. When you print to the default printer, Harvard ChartXL uses the Options settings in the Windows Control Panel.

To change from the default printer or printer options:

Choose **Print Setup** from the File menu. The printer drivers installed on your computer appear in the Specific Printer list. Select the printer you want to use. Choose Portrait or Landscape and select your paper size and source. Click the Options button to display the Options dialog box for the selected printer. Click OK.

Using Page Setup

You can control the portion of the spreadsheet to print, and where it prints on the page. You can also control whether to print gridlines, column letters, and row numbers.



To select a range to print:

Choose **Page Setup** from the File menu. The Print Range area in the Spreadsheet Page Setup dialog box displays the range of your spreadsheet that currently contains data. If you want to print a portion of your data, change the range designation by typing a new range.

Note: If your spreadsheet contains multiple tables, and you want to print one table, you do not need to use Print Range in the Spreadsheet Page Setup dialog box. When you choose **Print** from the File menu, you can print the whole spreadsheet or a single table.

To set margins:

Choose **Page Setup** from the File menu. Type the margins you want to use in the Spreadsheet Page Setup dialog box, or use the arrows to the right of each margin setting. Click OK.

To choose page orientation:

Choose **Page Setup** from the File menu. Click to select Portrait or Landscape in the Spreadsheet Page Setup dialog box. This can also be done in the Print Setup dialog box. Click OK.

To control the printout of gridlines:

Choose **Page Setup** from the File menu. Click to select Print Gridlines in the Spreadsheet Page Setup dialog box. This controls the printout of the spreadsheet, but does not affect the display of gridlines on your screen. If you applied Borders or Fills to any cells, the Borders and Fills print. Click OK.

To control the printout of row and column headings:

Choose **Page Setup** from the File menu. Click to select Row/Col Headings in the Spreadsheet Page Setup dialog box. Click OK.

Printing

Once the spreadsheet is the way you want it, you can print it.

To print a spreadsheet:

1. Choose **Print** from the File menu. Type the number of copies in the Print Spreadsheet dialog box. If you have a spreadsheet with multiple tables, select the table(s) you want to print. Click OK to print the specified table and range to the selected printer.
2. Or, click the Print Spreadsheet button. Type the number of copies in the Print Spreadsheet dialog box. If you have a spreadsheet with multiple tables, select the table(s) you want to print. Click OK to print the specified table and range to the selected printer.

Note: The options you choose while in a spreadsheet are saved with that spreadsheet and apply to that spreadsheet. Changing the printer options for a spreadsheet does not affect your file. If you already set options for a spreadsheet, choose **Print** from the File menu or click the Print Spreadsheet button to print your spreadsheet.

Working with Formulas

Overview of Working with Formulas

Working with Formulas explains how to use formulas, functions, and variables to create a spreadsheet. Data can be typed into a spreadsheet or can be created using formulas.

General Cell Address Conventions

Whether you are referring to a single cell or a range of cells, the way to define the cell address is the same. These cell address conventions apply to variables, formulas, and functions.

A cell address can either be "fixed" or "relative." When a variable or range address representing a fixed cell address is used in a formula, the value of that cell is used for each cell being initialized by the formula. However, when a relative cell address is used, the value of the designated cell is used in the first cell being initialized; subsequent initialized cells use the contents of the cell with the same column and/or row offset that the first initialized cell had with the designated cell.

Either the cell address row, column, or both may be fixed by prefixing the corresponding address with the "$" symbol. Thus, a cell at location A1 with a fixed row address and relative column address is denoted "A$1" whereas the same cell with a fixed column address and relative row address is denoted "$A1". The same cell with both a fixed row and column address is denoted "$A$1".

Since every Harvard ChartXL spreadsheet can contain up to 255 tables, a complete cell address references the table in which the cell resides as well as the row and column. Tables are numbered sequentially, T1, T2, T3, T4..., etc. A fixed or relative cell address is complete when it is prefixed with a T1 or T2, etc.

Note that if you omit a table reference from a cell address, Harvard ChartXL assumes you are referring to a cell in the current table. This is convenient when you are working in a single table but important to remember when you are working in other tables.

Table references can also be fixed or relative. To indicate a fixed table reference, "$" should be entered as a prefix to the table designator.

In Harvard ChartXL, a spreadsheet range is defined as a rectangular region of cells in a single table, or a cubic region of cells if more than one table is specified in the range.

Note: If you copy or cut and paste formulas between cells, it is important to use the fixed and relative cell designations. If you copy formulas based on relative cell addresses, the ranges in the formula change to reflect the new location. If you use fixed cell addresses, you can force certain portions of your formula to be based on a set location, instead of adjusting the formula for the new location.

The format of a spreadsheet range is one cell address separated by a colon (:) from another cell address. Examples of spreadsheet ranges include the following:

Range	Result
A1:C2	Specifies a rectangular range of relative cell addresses in Table 1 including A1, B1, C1, A2, B2 and C2.
$T1$A$1:$T3$C$2	Specifies a cubic range of cell addresses with fixed tables, fixed columns, and fixed rows.

Variables

The function of a variable is to allow you to name a range, instead of typing or selecting that range when you need to refer to it. Variables can be used with formulas, pre-defined functions, and for graphing. Harvard ChartXL allows you to create variables representing single cell addresses for two or three dimensional spreadsheet ranges. When a variable is created, it is saved with, and available to the spreadsheet in which it was created. Once you create a variable, it can be used in many ways.

- To specify a data range for a graph through the graph range commands in the Graph menu or the Range Highlighter.
- As independent components of formulas or as function arguments in formulas, including those entered using the Paste Function command.

A variable name can be any combination of letters totaling 127 characters. The associated spreadsheet range must designate the address of at least one cell. You can even set two variables equal to each other. This initializes the spreadsheet range for the variable on the left side of the formula to the value of the variable on the right side of the formula. This feature allows you to create interdependencies among variables.

Note: Harvard ChartXL is sensitive to the case of variable names. This gives you flexibility in naming variables. However, when you reference a variable, you must use the same upper and lower case letters to match the variable name.

Creating Variables

Variables exist in the spreadsheet in which they were created. To use a variable in a spreadsheet, you must create it in that spreadsheet.

To create a variable:

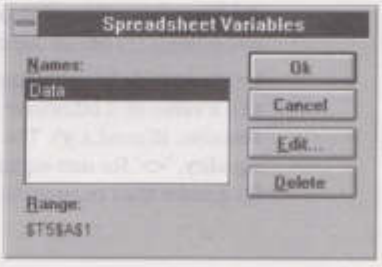
1. Open the spreadsheet you want to create a variable in. Choose **Create** from the Variable menu. Type a name for your variable in the Create Variable dialog box (remember that the names are case sensitive). Type the range you want that variable to represent. Click OK to define the new variable.
2. Or, open the spreadsheet you want to create the variable in. Click the cell (or use your mouse to select a range) you want to define as a variable. Choose **Create** from the Variable menu and enter the information in the Create Variable dialog box.

Viewing and Editing Variables

Existing variables can be viewed and changed.

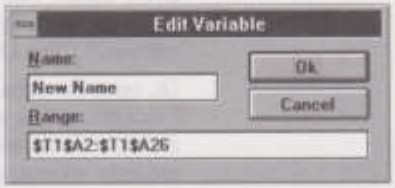
To view a variable:

Open the spreadsheet that contains the variable you want to view. Choose **List** from the Variable menu. Any variables that exist in the current spreadsheet are displayed in the Spreadsheet Variables dialog box. The range assigned to the highlighted variable is displayed at the bottom of the dialog box. Click a variable name to view its defined range. Click OK or Cancel to return to the spreadsheet.



To change a variable name or range:

Open the spreadsheet that contains the variable you want to change. Choose **List** from the Variable menu. Click the variable name that you want to change. Click Edit. Type a new name in the Name box, or the Range box to define a new range in the Edit Variable dialog box. Click OK to accept the changes and return to the Spreadsheet Variables dialog box. Click OK when you are finished editing variables.



Deleting Variables

When you delete a variable, all occurrences of that variable in formulas are converted to the spreadsheet range defined for that variable. Your formulas will still be valid, even though the variable name no longer exists.

To delete a variable:

Open the spreadsheet that contains the variable you want to delete. Choose **List** from the Variable menu. Any variables that exist in the current spreadsheet are listed in the Spreadsheet Variables dialog box. Click the variable name you want to delete. Click Delete to delete the selected variable. Click OK to close the dialog box and return to the spreadsheet.

Formulas

Harvard ChartXL allows you to create formulas using a wide range of functions and basic arithmetic operations.

Addition (+), subtraction or negation (-), multiplication (*), division (/), and powers (^) are all supported in formulas.

Logical symbols are supported which return a value of 1 if they are true and a value of 0 otherwise (primarily intended for the conditional function, if(cond,x,y). The recognized logical symbols are '==' for equality, '<>' for non-equality, '>' for greater than, '< for less than, '>=' for greater than or equal to, and '<=' for less than or equal to.

Creating Formulas

Harvard ChartXL allows you to initialize a spreadsheet range using a constant, a variable, or a user-defined formula. You can do this from any cell in any table in a spreadsheet. Ranges of data can be defined on the left side of the equation as well as the right, giving you greater flexibility in writing formulas and creating ranges of data.

For example, suppose you created a variable, "X", representing the value in a single cell. Let us also suppose you created another variable, "Y", which represents a cell range. The following table shows examples of entries you can make anywhere in the spreadsheet and the results of those entries.

Note: There are three ways to specify ranges (or single cells) on either side of the = sign in a formula:

- Type the range
- Select the range
- Enter a variable name.

Entry	Result
=9	Sets the value of the specified cell or range to 9.
=X	If a single cell is selected, sets the value of that cell equal to the first value in the range specified by the variable "X". If a range of cells is selected, sets the value of that range equal to the values of the range defined as "X". If "X" is the result of a formula, this new formula will change as the values of "X" change.
=Sin(X)	Sets the value of the specified range equal to the sine of the values in the range defined as "X".
A1=T3C2	Sets the value of cell A1 in the current table equal to the value of T3C2, regardless of which cell is currently active in the spreadsheet. Cell A1 is then automatically updated by changes to T3C2.
T2A1=T3C2	Sets the value of cell T2A1 equal to the value of T3C2, regardless of which cell is currently active in the spreadsheet. Cell T2A1 is then automatically updated by changes to T3C2.
T2A1=Sin(X)	Sets the value of cell T2A1 equal to the sine of the value in the first cell of the range defined as "X". Cell T2A1 is then automatically updated by changes to the value of the cell represented by "X".

A2:A40=A1+4	Sets the value of each cell in the range from A2:A40 to be equal to the value of the cell above it plus 4. Cell A2 equals cell A1 plus 4, cell A3 equals cell A2 plus 4, etc. If you copy this formula to another column, the column letters on both sides of the = sign change to reflect the new location. The range on the left can be specified using a variable name, rather than typing the range address.
A2:A40=$A1+4	Sets the value of each cell in the range from A2:A40 to be equal to the value of the cell above it plus 4. Cell A2 equals cell A1 plus 4, cell A3 equals cell A2 plus 4, etc. If you copy this formula to another column, only the column letters on the left side of the equation change. The A column is fixed for the right side of the equation. The range on the left can be specified using a variable name, rather than typing in the range address.
A2:A40=$A$1+4	Sets the value of the range from A2:A40 to be equal to the value of cell A1 plus 4. Cell A1 is specified as fixed, and is the only cell used in the formula. The range on the left can be specified using a variable name, rather than typing in the range address.

To create a formula:

- Open the spreadsheet you want to create a formula in. Click the cell you want the formula to appear in. Type your formula based on the examples above. You can type range definitions or variable names on either side of the = sign. Press Enter to create the formula.
- If you press Enter and nothing happens, check the Options menu to make sure Auto Recalc is turned on.

Note: You can use a formula to generate a series of numbers in a specified range. Ranges can be specified on both sides of an equation.

Example 1: You want to fill the A column with numbers from 1 to 100, in increments of .5. Click cell A1 and type 1. Press the Down Arrow key to move to cell A2. Type: A2:A200=A1+.5. When you press Enter the range from A1 to A200 is filled with the numbers from 1 to 100 in increments of .5.

Example 2: You want to fill the 1st row with random numbers from 1 to 100. Click cell A1 and type: A1:Z1=randu(1,100). When you press Enter, the range from A1 to Z1 is filled with random numbers between 1 and 100.

Viewing and Editing Formulas

When you initialize a spreadsheet range with a formula, the values calculated by the formula are displayed in each cell. If you click any cell in the initialized range, the formula is displayed in the white display area above the spreadsheet window. You can edit the formula to change the values for all cells in the specified range.

To edit a formula:

1. Click any cell in the range that was created by the formula.
2. Click in the white display area, where the formula is displayed. Use your keyboard to change the formula. Press Enter, or click the green checkmark to accept the new formula. Click the red X, before pressing Enter, to revert to the original formula.

Copying, Cutting, Pasting, Clearing, and Deleting Formulas

Formulas can be copied, cut, and pasted just like any other data in the spreadsheet. It is important to be aware of the differences between fixed and relative cell addresses when you are moving formulas between cells.

When you clear the formulas from a range, the last calculated values for those cells are taken as their values. You can also clear all formulas and formatting from a spreadsheet by saving it as a .DAT file.

To clear a formula from a range:

To clear a formula from the range it has initialized, you must enter a constant value in the anchor cell. The anchor cell for a rectangular range is the upper leftmost cell. In a cubic range, the anchor cell is the upper leftmost cell in the beginning table for the range. Click the anchor cell and type the value that is displayed in the cell. Press Enter to clear the formula and convert all cell entries in the specified range to values.

To delete a formula:

Deleting a formula has the same effect as clearing a formula. When you delete, the value in the selected cell or range of cells is deleted when the formula is cleared. Any cells in the range specified by the formula that are not selected when you press Delete are converted to values.

Pre-Defined Functions

Harvard ChartXL comes with over sixty-nine pre-defined functions. These functions can be used in formulas, and in the Formula Solver (for the basic arithmetic and trigonometric functions). Using the Paste Function command in the Edit menu allows you to paste any of these functions into a cell or range of cells. All the functions available are listed below with a definition of the function, and a list of arguments and domain restrictions, if any.

abs(value)	Computes the absolute value of a number, cell or cell range.
acos(value)	Computes the inverse cosine of a number, cell or cell range in the range 0 to 180 degrees. The value must be within the range (-1,1) inclusive.
acosh(value)	Computes the inverse hyperbolic cosine of a value, cell or cell range.
asin(value)	Computes the inverse sine of a value, cell or cell range in the range -90 to +90 degrees. The value must be within the range (-1,1) inclusive.
asinh(value)	Computes the inverse hyperbolic sine of a value, cell or cell range.
atan(value)	Computes the inverse tangent of a value, cell or cell range within the range -90 to +90 degrees.
atan2(x,y)	Computes the inverse tangent of (x,y) within the range -180 to +180 degrees. Either x or y must be non-zero.
atanh(value)	Computes the inverse hyperbolic tangent of a value, cell or cell range. The value must be within the range (-1,1) inclusive.
avdev(range)	Computes the average deviation of a range of data.
ave(range)	Computes the average of a range of data.
besselj(n,x)	Computes the Bessel function of the first kind of order n of the value x. N must be an integer in the range (0,9) inclusive.
bessely(n,x)	Computes the Bessel function of the second kind of order n of the value x. N must be an integer in the range (0,9) inclusive.
beta(z,w)	Computes the standard beta function: B(z,w).
betai(a,b,x)	Computes the incomplete beta function: Ix(a,b).

ceil(value)	Computes the smallest integer that is greater or equal to a value, cell or cell range.
Chi2Prob(x2,n)	Computes the Chi-square probability function: $P(x^2/n)$
Chi2TestProb(range,range,constraints)	Computes the Chi-square test probability for binned data.
Chi2TestStat(range,range,constraints)	Computes the Chi-square test statistic for binned data.
comb(int, int)	Computes the number of combinations of an integer in a range of cells. Both integers must be non-negative and the second one must be less than or equal to the first.
corrcoef(range,range)	Computes the Correlation coefficient for two ranges of data.
cos(value)	Computes the cosine of a value, cell of cell range.
cosh(value)	Computes the hyperbolic cosine of a value, cell or cell range.
count(range)	Computes the number of cells in a given range of data.
delta(value)	Computes the Kronecker delta function of a value, cell or cell range, resulting in a value of 1 when the input is 0, and a value of 0 otherwise.
erf(range)	Computes the error function of a range of cells.
erfc(value)	Computes the complimentary error function of a value, cell or cell range (1-erf(x)).
exp(value)	Computes the exponential of a value, cell or cell range.
fact(int)	Computes the factorial function for a value, cell or cell range.
floor(value)	Computes the largest integer that is less than or equal to a value, cell, or cell range.
fprob(F,n1,n2)	Computes the distribution probability function: Q(F/n1,n2), where F is the variance ratio.
FTestProb(range,range)	Computes the F-test probability for two ranges of data.
FTestT(range,range)	Computes the F-test statistic for two ranges of data.
gamma(value)	Computes the gamma function, $\Gamma(x)$, of a value, cell or cell range. The number may be any real value except non-positive integers.
gammai(a,x)	Computes the Incomplete gamma function: P(a,x).

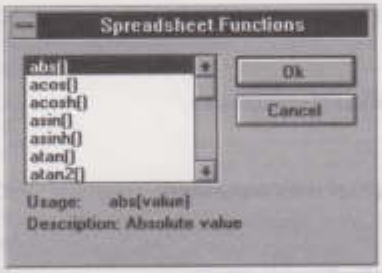
gaussq(value)	Computes the Gaussian Q-function of a value, cell, or cell range.
if(cond,value,value)	Returns the first value if the condition, cond, is true (non-zero) and the second value if it is false (zero).
int(value)	Truncates the fractional part of a value, cell or cell range.
KSTestProb(range,range)	Computes the Kolmogorov-Smirnov test probability for two ranges of data.
KSTestStat(range,range)	Computes the Kolmogorov-Smirnov test statistic for two ranges of data.
kurt(range)	Computes the statistical kurtosis (4th moment) for a range of data.
ln(value)	Computes the natural logarithm of a value, cell, or cell range. Input must be positive.
log(value)	Computes the Base-10 logarithm of a value, cell or cell range. Input must be positive.
max(range)	Computes the maximum of a range of data.
median(range)	Computes the median value for a range of data.
min(range)	Computes the minimum of a range of data.
mod(value)	Computes the modulus (integer remainder) of a value, cell, or cell range. Input must be positive.
perm(int, int)	Computes the number of permutations of the first integer, taken n at a time (where n is the second integer). Both inputs must be non-negative integers and the second one must be less than or equal to the first.
pi	Returns the constant 3.1415926535...
randn(mean,var)	Computes a Gaussian random variable with mean and variance input.
randu(a,b)	Generates a uniform random variable between the values a and b, inclusive.
sgn(value)	Computes the polarity sign of a value, cell, or cell range. Returns a 1 if input is positive, a -1 if input is negative, and a 0 if input is 0.
sin(value)	Computes the sine of a value, cell, or cell range.
sinc(value)	Computes sin(pi*value)/(pi*value).

sinh(value)	Computes the hyperbolic sine of a value, cell, or cell range.
skew(range)	Computes the skew (3rd moment) for a range of data.
sqrt(value)	Computes the square root of a value, cell, or cell range. Input must be non-negative
stdev(range)	Computes the standard deviation (n-1) for a range of data.
step(value)	Computes the step function of a value, cell, or cell range. Returns a 1 if input is non-negative, and a 0 otherwise.
studentprob(t,n)	Computes the student's distribution probability function: A(t/n).
sum(range)	Computes the sum of a range of data.
tan(value)	Computes the tangent of a value, cell, or cell range.
tanh(value)	Computes the hyperbolic tangent of a value, cell, or cell range.
TTestDifVarProb(range,range)	Computes the probability for student t-test (different variance case) for two ranges of data.
TTestDifVarT(range,range)	Computes the T-statistic for student t-test (different variance case) for two ranges of data.
TTestEqVarProb(range,range)	Computes the probability for student t-test (equal variance case) for two ranges of data.
TTestEqVarT(range,range)	Computes the T-statistic for student t-test (equal variance case) for two ranges of data.
TTestPairedProb(range,range)	Computes the probability for student t-test (paired sample case) for two ranges of data.
TTestPairedT(range,range)	Computes the T-statistic for student t-test (paired sample case) for two ranges of data.
var(range)	Computes the statistical variance for a range of data.

Using a Function in a Formula

There are two ways to use a function in a formula.

1. Click a cell or select a range for the result of the calculation. Type = and define your function. For example, to compute the statistical variance for the values in the range from A2:A50, type **=var(A2:A50)**. Press Enter to perform the calculation. The result is displayed in the region that was selected before you typed the equal sign.
2. Or, click a cell or select a range for the result of the calculation. Choose **Paste Function** from the Edit menu. Click the function you want to use in the Spreadsheet Functions dialog box and click OK. The function is displayed in the white display area above the spreadsheet, with the first variable or argument highlighted. Type in a value, or a range (as required for the selected function). For example, to compute the statistical variance for the values in the range from A2:A50, select var(range) and click OK. Then type A2:A50. Press Enter to perform the calculation. The result is displayed in the region that was selected before you pasted the function.



Note: There are three ways to specify the range for the result (on the left side of the equal sign) or for the argument of the function (on the right side of the equal sign).

- You can select a range
- You can type a range address
- You can type a variable name

Working with Graphs

Overview of Working with Graphs

Harvard ChartXL allows you to add over 47 different types of graphs and to set options to display data in the way that you want. You can also add graphs using the Graph Gallery, which has over 180 predesigned graphs available as templates.

Working with Graphs has detailed information about the Graph Gallery and setting options for the display of data.

For information on creating a graph, see **The Basics**.

For more information on the style options for a specific type of graph, see specific graphs types in **Business Graphs**, **Technical Graphs**, and **Statistical Graphs**.

For information on adding text and graphical objects, see **Working with Graphics and Text Annotations**.

Working with the Graph Gallery

The Graph Gallery contains over 180 preformatted business, statistical, and technical graphs. Each graph in the Gallery has an associated description, which you can read for details on the structure and applications of the graph, and a sample spreadsheet, which you can use to prepare your own spreadsheet.

You can add your own graphs to the Gallery to use as a template. You can also edit the Graph Gallery.

For information on selecting a graph in the Gallery and using it as a template for creating a graph, see *Using the Graph Gallery* in **The Basics.**

Adding a Graph to the Graph Gallery

If you create a graph you want available as a template for other data sets, you can save it to the Graph Gallery. Graphs saved to the Graph Gallery retain the following attributes:

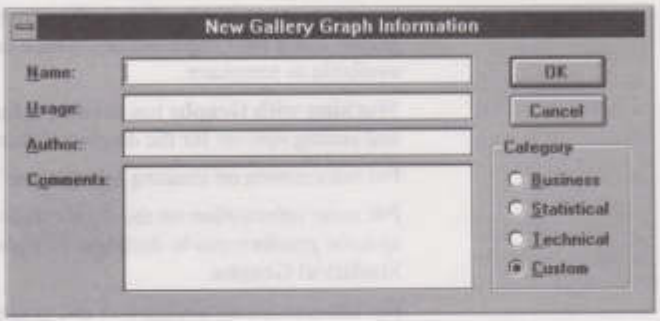
- Character formatting for axis labels, axis title, or legend.
- Color, symbol, line style, and fill formatting.
- Ranges from the spreadsheet as defined by the Range Highlighter.

- Any changes made through the Graph Style dialog box or Axis Style dialog box.
- The size of the graph.

To keep your own graphs separate from the ones supplied with Harvard ChartXL, you may want to store these special graphs in the Custom section of the Gallery.

To add a graph to the Graph Gallery:

1. Create and format the graph as desired and select it. Choose **Save Gallery Graph** from the File menu.
2. In the Save As dialog box, enter a filename and click OK. The file is automatically saved with a .GRF extension. The New Gallery Graph Information dialog box opens.



3. Enter information about the graph.

Name	Accepts entry of the name for your graph as it is displayed in the Graph Gallery.
Usage	Accepts entry of graph usage information for display in the Graph Gallery Information area.
Author	Accepts entry of the name of the creator of this graph for display in the Graph Gallery Information area.
Comments	Accepts entry of any general comments on the graph for display in the Graph Gallery Information area.
Category	Places your graph in the category you select

4. Graphs in the Graph Gallery must have sample data files attached to them. Harvard ChartXL takes the spreadsheet you used to create the graph and saves it as a .DAT file. Click OK to proceed.
5. The Save As dialog box opens with .DAT listed as the File Type. Harvard ChartXL automatically assigns the same name to the data file that was given to the .GRF file. Click OK to accept the file name.

Editing the Graph Gallery

To change the information about each Gallery graph:

Open the Graph Gallery and click the Edit Info button. The Graph Information dialog box opens, allowing you to edit the information that is stored with the graph.

To delete a graph:

Open the Graph Gallery. Select the graph that you want to delete and click the Delete button.

Note: When you delete a graph from the Graph Gallery, the picture of the graph is deleted but the .GRF and .DAT files associated with it are not deleted.

To reorder the graphs in the Graph Gallery:

Click a graph to select it. Hold down the mouse button and drag the graph to a new location.

Range Highlighter Options and the Display of Data

The Range Highlighter is used to help plot data on a graph. It displays the ranges (or locations) of data that are currently used in a selected graph. It allows you to change and define the ranges you want to plot. For more about the Range Highlighter, see *Setting and Viewing Graph Ranges* in **Working with Spreadsheets**.

Each type of graph has its own Range Highlighter. For detailed information about Range Highlighters for each type of graph, see **Business Graphs**, **Technical Graphs**, and **Statistical Graphs**.

Changing Style Options for a Graph

The style for a graph includes data display options such as color and axis assignments. Each graph type has a Style dialog box where you can control the style options. Some style options are available for almost all graphs; for example, there is an Axis Assign button in every Style dialog box and a Colormap button in many of them.

Other style options are specific to each graph type. These are displayed and explained in detail in **Business Graphs**, **Technical Graphs**, and **Statistical Graphs**.

To change the style options for a graph:

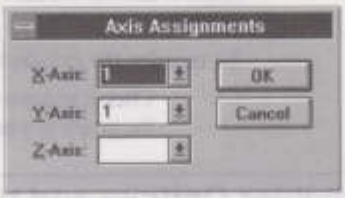
1. Select the graph and choose **Style** from the Format menu or double-click the graph to open the Style dialog box.
2. Make your changes and click OK.

Assigning a Data Set to an Axis

1. Select the data set you want to assign, then choose **Style** from the Format menu or double-click the graph to open the Style dialog box.

   For information on selecting a data set, see *Selecting Graphs and Graph Parts*.

2. Click the Axis assigns button. The Axis Assignments dialog box opens. All existing axes for the selected graph are listed in the order in which they were added to the graph.



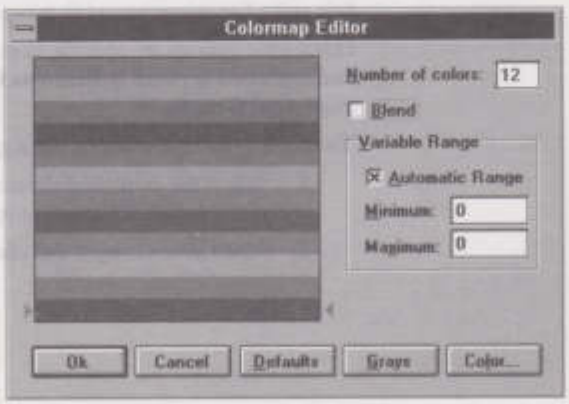
3. Select the axis number that you want assigned to the selected data set. Click OK to return to the Style dialog box.
4. Click OK to close the Style dialog box. The selected data set is attached to the specified axis and that axis is scaled and labeled accordingly.

Setting Colormap Options

The Range Highlighter allows you to define a range of the spreadsheet for colormapping a graph. The Colormap key button in a Style dialog box allows you to define the options for the colormapped range used on the graph.

To set colormap options:

1. Click the Colormap key button in the Style dialog box for the selected data set. The Colormap Editor dialog box opens.



Number of colors	Set the number of colors that the variable range is divided into.
Blend	Causes the colors to be blended on your graph, rather than being displayed as distinct bands of color.
Variable Range	Sets the minimum and maximum values for the colormap. This range is divided by the number of colors to obtain the values for each color range. If automatic range is checked, the range is defined by the data values plotted on your graph.

2. Change the settings as needed and click OK to return to the Style dialog box.

To change the colors used in the colormap:

1. Turn off the Blend option. This makes the bands of color easier to choose.
2. Click the band you want to change. Arrows on either side of the display area indicate the selected color band.
3. Click the Color button. The Palette Selection dialog box opens. where you can choose new colors. For information on selecting fill colors and patterns, see *Selecting Fill Colors and Patterns*.
4. Select a new color and click OK to return to the Colormap Editor dialog box. Do this for each color that you want to change.

Note: Click the Defaults button to return to the default colors. Click the Grays button to convert the colors to gray scale.

Formatting Options for Graphs

You can select, resize, move, and arrange graphs and parts of graphs. You can also cut, copy, and paste them. Change the appearance of a graph frame, curve color and fill, data labels, symbols for data points, legends, and axes.

Selecting, Resizing, Moving, and Arranging Graphs

Graph frames, axes, legends, and data sets are considered separate objects, and can be selected, moved, and arranged like any other object.

For basic information about working with objects in Harvard ChartXL, see *Tips for Working with Data and Objects* in **The Basics**.

Selecting Graphs and Graph Parts

Graphs consist of multiple parts, each of which can be selected and formatted independently.

Select parts of a graph by first selecting the entire graph (click at the top of the graph or just outside the top). Then press tab to select in sequence the X-axis labels, X axis, Y-axis labels, Y axis, data points, and each data set.

The display bar at the lower left corner of your screen indicates the currently selected object. Below is a list of the different parts that make up a graph.

Graph	If it says "Edit Graph" at the lower left corner of your screen, you have selected the entire graph, including the individual graph parts.
Axis	Each axis on a graph can be individually selected and formatted. "Edit Axis" appears at the lower left corner of your screen, and the selected axis is highlighted.
Axis Labels	The axis labels for each axis can be selected individually (not each axis label, but the group of labels for each axis). "Edit Axis Labels" appears at the lower left corner of your screen and the selected axis labels are highlighted.
Axis Title	If you added axis titles to your graph, they can be selected and formatted individually. "Edit Axis Title" appears at the lower left corner of your screen and the selected axis title is highlighted.
Data	Each data set on a graph can be selected and formatted individually. A data set is created when you first create a graph, and each time you use the Add Data command. "Edit {data type}" appears at the lower left corner of your screen and the selected data set is highlighted.

Resizing, Moving, and Setting the Drawing Order for Graphs

Resizing: When you resize a graph, the frame, the axes, and the plotted data are rescaled accordingly. Axis labels, axis titles, and data point labels are not rescaled automatically. You must change the font size to rescale text on a graph.

Moving: If you select an entire graph, the graph frame and all of its parts are moved as a single unit. If you select an axis, or a set of axis labels, just the axis moves. If you select a data set, the graph frame and all the parts move as a single unit.

Setting the drawing order: The drawing order functions apply to multiple graphs on the screen and not to individual graph parts.

Copying, Cutting, Pasting, and Deleting Graphs

Graph frames, axes, legends, and data sets are considered separate objects and can be copied, cut, pasted, and deleted like any other object. Use the Windows clipboard to cut, copy, and paste.

Copying Graphs and Graph Parts

If you select an entire graph, the graph frame and its parts are copied as a single unit. If you select an axis, or a set of axis labels, just the axis is copied. If you select a data set, just the data set is copied.

Cutting and Deleting Graphs and Graph Parts

If you select an entire graph, the graph frame and its parts are cut as a single unit. If you have more than one of any axis type (X, Y, or Z) on the graph, only the selected axis is cut. If you have one of any axis type, the entire graph and all graph parts are cut. Axes can be added using the Add Axis command. If you have more than one data set on the graph (created using the Add Data command), just the selected data set is cut. If the graph consists of a single data set, the entire graph and all graph parts are cut.

Pasting Graphs and Graph Parts

If you copied or cut an entire graph to the clipboard, the entire graph is pasted on the page.

If you copied or cut an axis to the clipboard, that axis is pasted on the page. You can then attach the pasted axis to a data set on an existing graph. If you copied or cut a data set to the clipboard, it can be pasted onto an existing graph as a new data set.

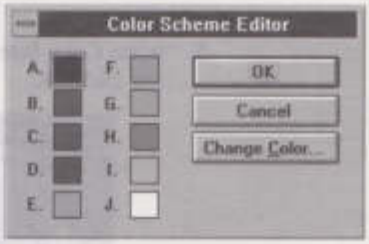
Changing the Color Scheme

The color scheme is a group of ten colors from the Harvard ChartXL color palette. You can select these ten colors from the colors in the default palette, or by combining varying amounts of red, green and blue. You can select from a potential palette of 16.7 million colors.

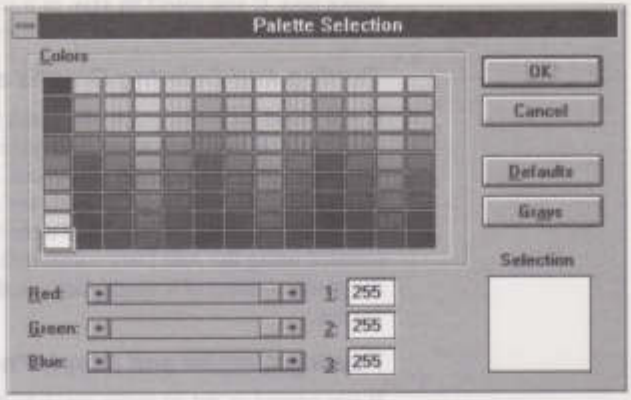
The color scheme can be changed at any time. Changing the color scheme does not change the color formatting of any existing objects; it simply provides a consistent palette of colors from which to choose when formatting graphs, text, and graphics.

To change the color scheme:

1. Select the graph and choose **Color** from the Format menu. Click Color in the Color Selection dialog box. The Color Scheme Editor dialog box opens.



2. Click the color you want to change, then click Change Color. The Palette Selection dialog box opens.



3. Choose a new color and click OK to return to the Color Scheme Editor.
4. Repeat for other colors you need to change, and click OK when you are finished.

Formatting a Graph Frame

The graph frame forms the background of the graph. The frame can be selected and formatted.

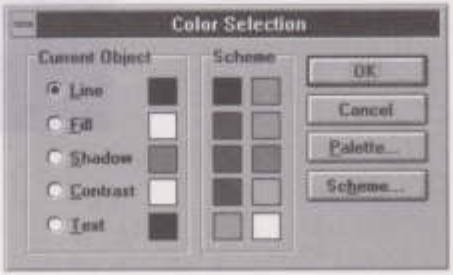
Selecting Fill Colors and Patterns

All new graphs have a solid white fill applied to them by default. You can change the color of the fill, apply a fill pattern to the frame, or remove the fill entirely.

To change the color:

1. Select the graph and choose **Color** from the Format menu or select the graph frame and click the Color button.

2. In the Color Selection dialog box, choose the color you want and click OK.



Current Object

Line
Click to choose a line color for the selected graph frame. Click to select a color in the Scheme section, or click Palette to choose a color from the Palette Selection dialog box.

Fill
Click to choose a fill color for the selected graph frame. Specifies the color for a solid fill or in combination with the contrast color in pattern and gradient fills. Click to select a color in the Scheme section, or click Palette to choose a color from the Palette Selection dialog box.

Shadow
Click to choose a shadow color for the selected graph frame. Specifies the shadow color in the Offset frame style. Click to select a color in the Scheme section, or click Palette to choose a color from the Palette Selection dialog box.

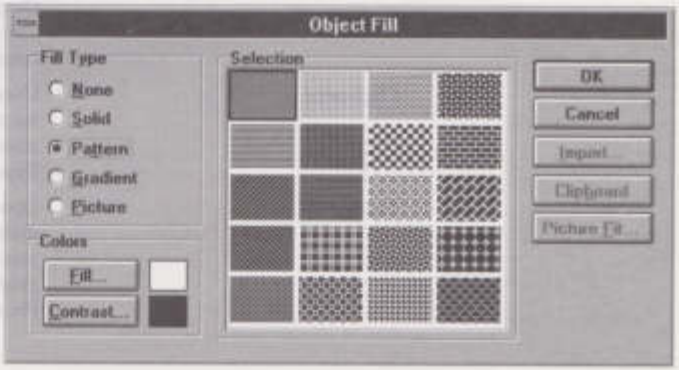
Contrast
Click to choose a contrast color for the selected graph frame. Specifies the color in combination with the fill color to produce fill patterns and gradient fills and the fill color for curve symbols. Click to select a color in the Scheme section, or click Palette to choose a color from the Palette Selection dialog box.

Text
This option does not apply to graph frames.

Scheme button
Changes the color scheme. See *Changing the Color Scheme*.

To apply a Fill pattern:

1. Select the graph frame, choose **Fill** from the Format menu.
2. The Object Fill dialog box opens. Choose a fill type and click OK to apply the fill to the selected graph frame.



Fill Type

None — Removes the fill from the selected object or objects.

Solid — Allows you to select a solid fill color for the selected graph frame. Use the Fill button to change the color.

Pattern — Displays a selection of fill patterns for the selected graph frame. Use the Fill and Contrast buttons to change the colors. Click the pattern to select it.

Gradient — Displays a selection of gradient patterns for the selected graph frame. Use the Fill and Contrast buttons to adjust the colors. Click the pattern to select it.

Picture — Allows you to Import a graphic file or to Paste an image from the clipboard as a fill for the graph frame.

Colors

Fill — Opens the Palette Selection dialog box, allowing you to select a fill color. The fill is the first color for a Pattern or Gradient.

Contrast — Opens the Palette Selection dialog box, allowing you to select a contrast color for a Pattern or Gradient. This selection does not apply to solid fill colors. The contrast is the second color for a Pattern or Gradient.

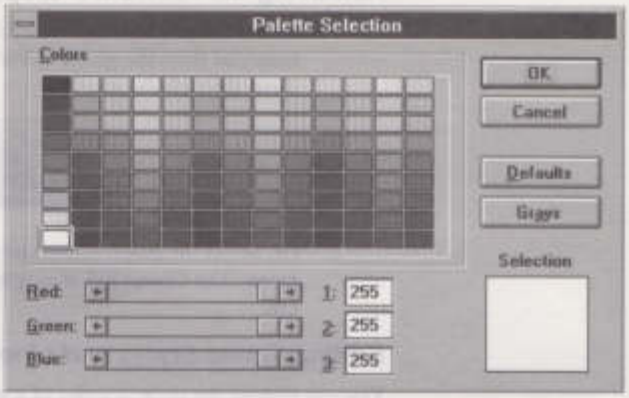
Selection — Displays a sample of the selected fill type. Click a fill type to select it for the selected graph frame.

Import — Displays the Import Picture dialog box which allows you to select a graphic file as a fill for the graph frame. For information, see *Importing Clipart Images* in **Working with Graphics and Text Annotations**. This button is active if Picture is selected for the Fill Type.

Clipboard — Uses the last object cut or copied to the clipboard as a fill. This button is active if Picture is selected for the Fill Type.

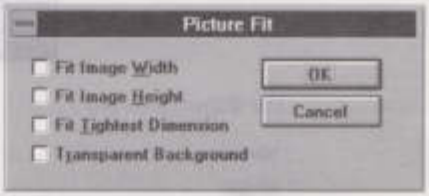
Picture Fit — Opens the Picture Fit dialog box. This dialog box allows you to define how you want a picture fill in the selected graph frame. This button is active if Picture is selected for the Fill Type.

To use the Palette Selection dialog box:



Click one of the predefined colors, or drag the Red, Green and Blue bars to create your own color. The selected color is displayed in the Selection box. Click the Grays button to view a palette of gray scale tones. Use the Defaults button to return to the default color palette. Click OK to use the selected color.

To use the Picture Fit dialog box:



Fit Image Width	Sizes the image being used as a fill to fit the width of the object being filled.
Fit Image Height	Sizes the image being used as a fill to fit the height of the object being filled.
Fit Tightest Dimension	Sizes the image being used as a fill to fit the smaller of the width or the height of the object being filled.
Transparent Background	Prevents the image being used as a fill from covering any objects beneath it on the page.

Note: If both Fit Image Width and Fit Image Height are selected, the image being used as a fill fits itself to the width and height of the object being filled. If neither are checked, the image being used as a fill is tiled in the object being filled.

Removing the Fill from a Graph Frame

1. Select the graph frame and click the Fill button. The fill is removed from the graph frame, allowing the backdrop color to show through the graph.

2. Or, select the graph frame and choose **Fill** from the Format menu. The Object Fill dialog box opens. Select None and click OK.

Editing Frame Styles and Line Styles

You can change the style or color of a graph frame, the line style of the frame, or you can remove the frame entirely.

To change the frame style:

Select the graph, choose **Frame Style** from the Format menu, and choose an option. Or select the graph and click a Frame Style button.

The frame styles are:

None	Removes any frames from the object.
Single	Applies the default, single line frame to the selected object.
Offset	Applies a frame with a shadow to the selected object.
Raised	Applies an embossed look to the frame for the selected object.

Note: Fill selected objects to get the best effect from Raised or Offset frame styles.

To edit the line style:

Select the graph and choose **Line Style** from the Format menu. In the Line Style Designer dialog box, choose options for the line style and click OK.

Width — Click the up and down arrows to select a width for the selected line. Or, click in the width display box and type a width. Widths are expressed in points.

Pattern — Use the scroll bar, or the up and down arrows, to select a solid or dashed pattern for the selected line.

End Cap — Select the style for the endpoints of the selected line.

Joints — Select the style for the joints of the selected line.

Color — Select a color for the selected line. The background color applies to dashed line styles. If Transparent is checked, the background color for a dashed line is clear.

Transparent — Turn on or off if you have patterned line styles to control whether gaps in the pattern are filled with the background color or are transparent to the background.

Sample — Displays a sample of the selected line style.

Removing the Frame from a Graph

Select the graph and choose **Frame Style** from the Format menu. Then choose None.

Changing Color and Fill for Curves and Data Points

Most of the graphs in Harvard ChartXL have default line styles or fills when they are created. (The exception being Scatter Plots and Vector Plots, which have curve symbols rather than curves or fills.) You can use the Style dialog box for each graph to apply automatic display options to an entire data set, or select individual data elements (curves or data points) within a data set and format them individually. For information on selecting data elements, see *Selecting Graphs and Graph Parts*.

Changing Line Colors

To change the color:

1. Select a single curve or multiple curves and choose **Color** from the Format menu or click the Color button.
2. The Color Selection dialog box opens. Choose a new line color and click OK to apply the new color to the selected curve or curves.

   See *Selecting Fill Colors and Patterns*.

Changing Line Styles

To change the style:

Select a single curve or multiple curves and choose **Line Style** from the Format menu. In the Line Style Designer dialog box, choose a new line style and click OK.

See *Editing Frame Styles and Line Styles*.

Changing Fill Colors or Patterns

You can select one or more filled data elements and change the fill color or fill pattern.

To change the fill color:

1. Select the filled data. Choose **Color** from the Format menu or click the Color button.
2. The Color Selection dialog box opens. Choose a new fill color and click OK to apply the new color to the selected data.

To change the fill pattern:

1. Select the filled data. Choose **Fill** from the Format menu or click the Color button.
2. The Object Fill dialog box opens. Choose a fill type and click OK to apply the new fill to the selected data.

See also *Selecting Fill Colors and Patterns*.

Data Labels

Labels can be added to data points to enhance the meaning of the data. They can be expressed as the actual values or as percentages of the data. Data labels can be defined in the spreadsheet as a range of characters representing anything you want.

Adding Data Labels

To add data labels to a graph:

Select the data point(s) you want to add data labels to. Choose **Data Labels** from the Format menu. In the Data Labels dialog box, select the format you want and click OK.

Display

Labels	Displays the label for each data point as indicated by the data labels range in the spreadsheet. This can be any range of cells and can be text or values.
Values	Displays the value of each data point.
Percentage	Displays the value of each data point as a percentage.

Location

Above	Displays the label above the associated data point.
Below	Displays the label below the associated data point.
Left	Displays the label to the left of the associated data point.
Right	Displays the label to the right of the associated data point.
Center	Displays the label at the center of the associated data point.
Perimeter	Displays the label at the perimeter of the associated data point.

Other Options

Increment	Specifies the interval at which data labels are displayed. For example, an entry of 3 displays labels at every third data point, after the first data point.
Distance	Accepts entry of the distance in points (1/72") of the label from the related data point, in the direction of the location specified.
Numbers	Displays a dialog box to format data values if the Values option is checked.

Formatting Data Labels

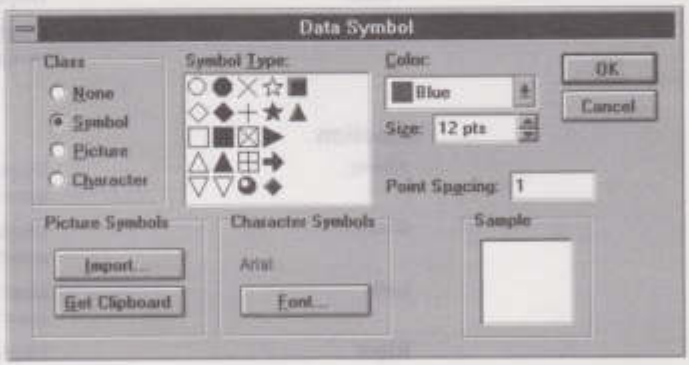
You can reopen the Data Labels dialog box and change the settings at any time. You can select multiple options in the Display area to show more than one type of label on a data point.

Data labels that are text follow the formatting rules defined in *Choosing Font Characteristics* in **Working with Spreadsheets**.

Data labels that are defined as values are numbers and follow the formatting rules defined in *Formatting Numbers* in **Working with Spreadsheets**.

Adding Symbols for Data Points

Select the data point(s) you want to add symbols to. Then choose **Curve Symbols** from the Format menu. In the Data Symbol dialog box, select the symbol you want to use and click OK.



Class

None	Removes the curve symbol from the selected data points
Symbol	Displays the pre-defined curve symbols in the Symbol Type area.
Picture	Allows you to import graphics into the Symbol Type area to be used as curve symbols.
Character	Allows you to select a font family to be displayed in the Symbol Type area (for example, a Wingdings symbol font).

Picture Symbols

Import	Opens the Import Picture dialog box and allows you to import a graphic image to be used as a curve symbol. For information, see *Importing Clipart Images* in **Working with Graphics and Text Annotations**.
Get Clipboard	Pastes the last object copied or cut into the clipboard into the Symbol Type area. The object can then be used as a curve symbol.

Character Symbols

Font	Opens the Font dialog box allowing you to select a font family to use as curve symbols.

Other Options

Symbol Type	Allows selection of a curve symbol by clicking on a given symbol.
Color	Click the down arrow to select from a list of colors.
Size	Accepts entry of the curve symbol point size (1/72") through direct entry or by using the spin control.
Point spacing	Accepts entry of a number specifying the frequency with which data points display curve symbols; 1 = every data point, 3 = every third data point, and so on.
Sample	Displays the selected curve symbol at its currently specified size and color.

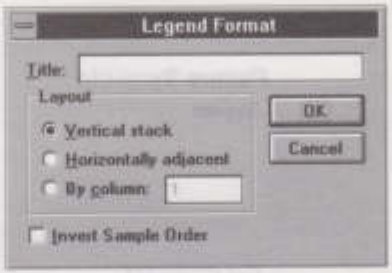
Note: You can change the color of symbols by clicking the Color button and selecting a new contrast color.

Legends

Harvard ChartXL allows you to add a legend to most graphs. The legend labels are defined from the spreadsheet and the symbols in the legend are automatically generated directly from the graph. If you are using Colormapping, the legend reflects the colors and ranges as defined in the Colormap Editor. If you use Add Data to add additional data sets to a graph, the additional data sets are reflected in the legend.

Adding a Legend to a Graph

Select the graph and choose **Add Legend** from the Graph menu. In the Legend Format dialog box, select the layout of the legend and click OK.



Title — Accepts entry of a title to appear at the top of the legend.

Layout

Vertically stack — Places legend entries one beneath the other.

Horizontally adjacent — Places legend entries side by side.

By column — Accepts entry of a number designating columns of legend entries. Harvard ChartXL automatically adjusts the placement of legend entries to fill the specified number of columns.

Invert Sample Order — Inverts the order of the entries in the legend.

Formatting Legends

You can format a legend as a text block. See *Choosing Font Characteristics* in **Working with Spreadsheets**.

Graph Axes and Grid Lines

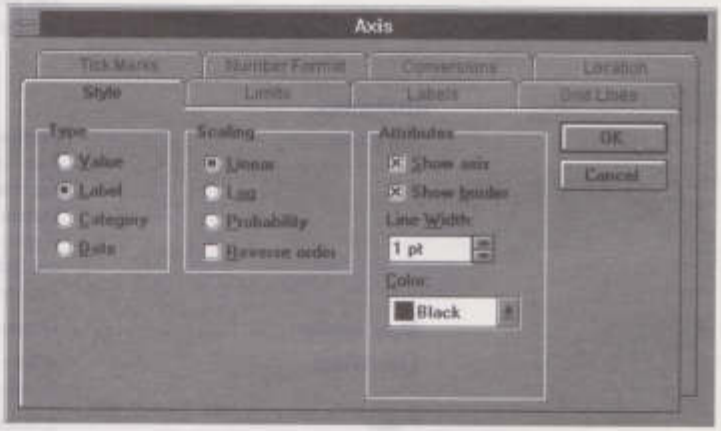
Axes and axis labels are automatically generated when you create a graph. You can make changes to them using the Axis Style dialog box. In addition, the font characteristics of axis labels can be changed through the text options on the Format menu. You can also add an axis title.

Formatting Axes and Axis Labels

Use the Style dialog box to format the axes and labels for a graph. Select tabs at the top of the dialog box to see different options.

To format an axis or its labels:

1. Select an axis and choose **Style** from the Format menu. The Axis Style dialog box opens with the Style tab activated.



2. Set the options you need.
3. Click the other tabs to change the options if you need to.
4. Click OK to apply the changes to the selected axis or labels.

These are the options in the Axis dialog box when the Style tab is selected:

Type

Value — Displays the axis labels as values. The axis is scaled from your lowest to your highest value.

Label — Displays the axis labels as text labels. The labels align themselves with the major tick marks.

Category — Displays the axis labels as text labels. The labels align between the major tick marks.

Date — Displays the axis labels as dates. The axis is scaled in time intervals, such as days, weeks, etc.

Scaling

Linear — Specifies linear scaling for the selected axis. You can specify the scale and optionally set a breakpoint for a linear axis by clicking the Limits tab.

Log — Specifies log scaling for the selected axis. You can specify the scale by clicking the Limits tab.

Probability — Selects probability scaling for the selected axis. You can't change the limits of a probability axis.

Reverse order — Reverses the order of the axis labels. The plotted data changes to reflect the reversed axis.

Attributes

Show axis — Displays the selected axis reference line. This does not affect the labels on the axis. Note that you can select a hidden axis by clicking where it was displayed or by using the Tab key and the Left and Right Arrow keys on your keyboard.

Show border — Displays the graph border or frame.

Line Width — Allows you to select a line width for the selected axis.

Color — Allows you to select a line color for the selected axis.

These are the options in the Axis dialog box when the Limits tab is selected, scaling is Linear, and the Axis type is Value, Label, or Category:

Linear Limits

Minimum — Allows you to set the minimum value when scaling the axis. If checked, the minimum value is auto scaled based on the data being plotted.

Maximum — Allows you to set the maximum value when scaling the axis. If checked, the maximum value is auto scaled based on the data being plotted.

Major ticks — Allows you to specify the increment at which major tick marks are displayed on the axis. If checked, the major tick marks are automatically calculated based on the data being plotted.

Minor ticks — Allows you to specify the increment at which minor tick marks are displayed on the axis. If checked, the minor tick marks are automatically calculated based on the data being plotted.

Breakpoint	Allows you to define a breakpoint in the axis scale by entering the lower and upper values for the break. This allows you to plot two different sets of data on the same axis.
Lower	Accepts entry of a number within the axis limits, representing the beginning of the break point or the point at which the lower part of the axis scaling is stopped.
Upper	Accepts entry of a number within the axis limits, representing the end of the break point or the point at which the upper part of the axis scaling is restarted.

These are the options in the Axis dialog box (in addition to the options above) when the Limits tab is selected, scaling is Linear, and the Axis type is Date:

Date Limits

Week starts on	Allows you to select the day of the week to begin with for labels using weeks.
2-Level Data Labels	For dates formatted with two time-scale components, such as *mmm yy*, displays the components separately on two lines. Redundant labels in the second line aren't displayed. For example, if axis labels are for two years using month labels (Jan 94 to Dec 95), the first line of labels would display Jan, Feb, and so on, and the second line would display 94 under the first occurrence of Jan and 95 under the second.

These are the options in the Axis dialog box when the Limits tab is selected, scaling is Log, and the Axis type is Value:

Logarithmic Limits

Minimum	Allows you to set the minimum value when scaling the axis. If checked, the minimum value is auto scaled based on the data being plotted.
Maximum	Allows you to set the maximum value when scaling the axis. If checked, the maximum value is auto scaled based on the data being plotted.

These are the options in the Axis dialog box when the Limits tab is selected, scaling is Probability, and the Axis type is Value:

The limits are fixed at 0.01 to 99.99.

These are the options in the Axis dialog box when Labels is selected:

Orientation

Parallel	Displays labels parallel to the axis.
Perpendicular	Displays labels perpendicular to the axis.
Slanted	Displays labels at a slant to the axis.

Placement

Center on tick mark	Centers each axis label under its associated tick mark.
Center on interval	Centers each axis label between its associated tick marks.
Right of tick mark	Places each axis label so that the first letter aligns with its associated tick mark and the remainder of the label goes off to the right.
Alignment	This option is available for axis labels with multiple words. Word-wrap must be turned on to use the alignment option.
Left	Sets all lines in the axis label to be left justified.
Center	Sets all lines in the axis label to be center justified.
Right	Sets all lines in the axis label to be right justified.
Justified	Sets all lines in the axis label to be full justified.
Word-Wrap	Displays multiple word axis labels on multiple lines.

Stagger Labels	Causes labels to alternate between two levels. Useful for long axis labels.
Distance to Axis	Accepts entry in points (1/72") or inches of the distance of the labels from the selected axis.
Auto space Second Line	Sets the spacing between lines, when the Word-Wrap or Stagger Labels options are used.

Display

Major Increments	Displays the major tick mark labels on the graph.
Minor Increments	Displays the minor tick mark labels on the graph.
First Label	Displays the first axis label.
Last Label	Displays the last axis label.
Increment	Sets the increment for axis labels to be displayed. An increment of 1 displays every label, an increment of 2 displays every other label, etc.
Character	Opens the Font dialog box, allowing you to choose a Font style for the selected axis labels.

Note: The Font style for Axis Labels can be defined by selecting the axis and using the Text tool bar or the format options for text.

These are the options in the Axis dialog box when Grid Lines is selected:

Major Grid

Show major grid	Displays the major grid lines on the graph.
Width	Allows you to select the line width for the major grid lines.
Pattern	Allows you to select the line style for the major grid lines.
Transparent	Applicable for a dotted or dashed line style only. If checked, causes the background color to be transparent. If not checked, causes the background line color to be displayed.
Foreground	Allows you to choose a line color for the grid lines. If you are using a dotted or dashed line style, sets the color of the dots or dashes.
Background	Allows you to choose a color for the spaces between the dots or dashes of a dotted or dashed line style. This color is not displayed if Transparent is checked.

Minor Grid

Show minor grid	Displays the minor grid lines on the graph.
Width	Allows you to select the line width for the minor grid lines.
Pattern	Allows you to select the line style for the minor grid lines.
Transparent	Applicable for a dotted or dashed line style only. If checked, causes the background color to be transparent. If not checked, causes the background line color to be displayed.
Foreground	Allows you to choose a line color for the grid lines. Sets the color of the dots or dashes for dotted or dashed line style.
Background	Allows you to choose a color for the spaces between the dots or dashes of the dotted or dashed line style. This color is not displayed if Transparent is checked.

These are the options in the Axis dialog box when Tick Marks is selected:

Major Tick Marks

Show major tick marks	Displays major tick marks on the selected axis.
Width	Allows you to select a line width for the major tick marks.
Length	Allows you to select a length for the major tick marks.
Color	Allows you to select a color for the major tick marks.

Minor Tick Marks

Show minor tick marks	Displays minor tick marks on the selected axis.
Width	Allows you to select a line width for the minor tick marks.
Length	Allows you to select a length for the minor tick marks.
Color	Allows you to select a color for the minor tick marks.

Tick Location

Inside	Displays tick marks inside the graph frame.
Outside	Displays tick marks outside the graph frame.
Across	Displays tick marks across the axis, appearing inside and outside the graph frame.

These are the options in the Axis dialog box when Conversions is selected:

Data Units	Allows you to apply a data conversion to the selected axis and its associated data set.
None	Specifies no data conversion.
Percent	Specifies a data conversion using the conversion formula $x_{out}=100x_{in}$.
Decibels	Specifies a data conversion using the conversion formula $x_{out}=10\log_{10}(\|x_{in}\|)$.
Octaves	Specifies a data conversion using the conversion formula $x_{out}=\log_2(\|x_{in}\|)$.
10^x	Specifies a data conversion using the conversion formula $x_{out}=10^{X_{in}}$.
Exponential	Specifies a data conversion using the conversion formula $x_{out}=e^{X_{in}}$.
Multiplier	Accepts entry of a data multiplier to be applied after data conversion. By combining the data conversion with a multiplier option, other units are also available. For example, if instead of plotting $10\log_{10}(\|x\|)$, you wish to plot $10\log_{10}(x^2)=20\log_{10}(\|x\|)$, you could select the decibels data conversion option and enter a multiplier of 2.

These are the options in the Axis dialog box when Location is selected:

Location On Graph	Allows you to set the location of the selected axis in relation to the graph frame.
Default	Sets the axis to the default location on the graph.
Opposite Side	Moves the axis to the opposite side of the default location.
Zero-Cross	Locates the axis on the zero mark of the axis perpendicular to the selected axis.
Offset	Allows you to specify a percentage to offset the selected axis from the graph.

Note: When the Number Format tab is selected in the Axis dialog box, you can apply formats to numeric values. See *Formatting Numbers* in **Working with Spreadsheets**.

Adding Axes to a Graph

Harvard ChartXL allows you to add an unlimited number of axes to any graph. When a new axis is added, it is not attached to any data sets and is scaled from 1 to 10. If you have added data using the Add Data command, new axes can be assigned to the data sets and are autoscaled accordingly. You do not have to attach additional axes to a data set.

To add an axis to a graph:

Select the graph you want to add an axis to and choose **Add Axis** from the Graph menu. In the New Axis Alignment dialog box, select the type of axis you want to add and click OK.

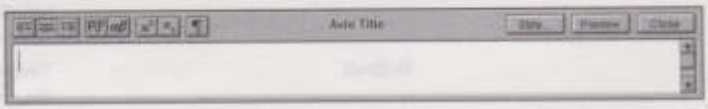
Note: The new axis is not attached to a data set and must either be scaled manually or attached to a data set using the Axis Assignments dialog box located in the Style dialog box for the graph. Each data set can be assigned to one axis in each alignment. If you want multiple axes assigned to multiple data sets, you must use the Add Data command to create separate data sets.

Adding Axis Titles

You can add titles to your axes to help identify their meanings. Once you have added a title to an axis, it becomes part of that axis and is cut, copied, deleted, or moved with the axis. The axis title can be selected separately from the axis for formatting. Each axis can have one axis title, but the axis title can contain multiple lines.

To add an axis title:

1. Select the axis that you want to add a title to and choose **Add Axis Title** from the Graph menu. The Axis Title window opens.



2. Type your axis title in the display area. Use the buttons in the Axis Title window to format the text. Click Preview to view the axis title on the graph without closing the editing window. Click Close to apply the axis title to the graph.

Position buttons

Position the axis title at the beginningcenteror end of the axis.

Other buttons

Opens the Font dialog box, where you can choose a font style for the axis title.

Begins or terminates symbol formatting to allow inserting Greek characters into your axis title. The Greek symbols can be added by typing their English equivalents after clicking this button.

Defines the next character typed (or the selected character) as a superscript. The size of the character can be changed using the Font button and the distance of the superscript above the normal text can be changed by choosing **Position** from the Format menu.

Defines the next character typed (or the selected character) as a subscript. The size of the character can be changed using the Font button and the distance of the subscript below the normal text can be changed by choosing **Position** from the Format menu.

Opens the Paragraph format dialog box where you can set paragraph options for multiple lines.

Style

Opens the Axis Title dialog box.

Placement

Places the title at the center, beginning or end of the axis

Axis distance

Allows you to specify, in points or inches, the distance of the axis title from the axis.

Perpendicular to axis

Rotates the axis title 90 degrees so that it is perpendicular to the axis.

To edit an axis title:

1. Select the axis title and choose **Edit Axis Title** from the Graph menu to open the Axis Title window.
2. Or, select the axis title and use the Format menu commands listed below to format the axis title.

Style	Opens the Axis Title dialog box.
Character	Opens the Font dialog box.
Paragraph	Opens the Paragraph format dialog box.

Note: If you use the Format menu commands or the Text tool bar to format an axis title, the changes are applied to the entire text block. If some characters are individually formatted (such as Greek characters or super-and subscripts), do not use the Character command or the Text tool bar to make your changes because you will change all characters in the axis title to the same font style.

Advanced Graphing

Harvard ChartXL gives you great flexibility in modifying graphs. If you are unsure of which graph type is best for your data, you can use the Change Graph command on the Graph menu to sample different graph types. If you create a graph format that you like, you can quickly view it with different data sets using the Change Data command. Data can be transposed on the graph with a single command and combination graphs can be created, allowing you to graph multiple data files or multiple data styles on a single graph.

Changing Graph Types

You can easily pick a new graph type for an existing data file or a new data file for an existing graph.

You can try different graph types for a data set to pick one that best displays your data. When you use the Change Graph command, some formatting and ranges specified in the spreadsheet may be lost.

To change the graph type and retain the data file:

1. Select the graph. Choose **Change Graph** from the Graph menu.
2. The Graph Selection dialog box opens. Select a new graph type and click OK. The spreadsheet does not open automatically because it is assumed you want to use the same spreadsheet ranges.

Using a Different Spreadsheet for an Existing Graph

Once you create a graph and format it to your liking, you may wish to use it with other spreadsheets. One method would be to save the graph to the Graph Gallery as a template. You can copy the graph and simply change the data set that is associated with it.

The Change Data command is useful if you want to quickly view various spreadsheets on a single graph. When you use the Change Data command, all formatting of the graph is retained. Only the data file being plotted is changed. The ranges that were defined in the spreadsheet are also retained.

To change the spreadsheet and retain the graph formatting:

1. Select the graph and choose **Change Data** from the Graph menu.
2. The Select Spreadsheet Resource dialog box opens. Select a new spreadsheet and click Display. The new data is applied to the existing graph. The spreadsheet does not open automatically because it is assumed you want to use the same spreadsheet ranges.

Transposing Data on an Existing Graph

The data being plotted on a graph can be transposed without opening the spreadsheet.

To transpose the data on a graph:

Select the data set you want to transpose. Choose **Transpose Data** from the Graph menu. The data is transposed on the graph, but not in the spreadsheet.

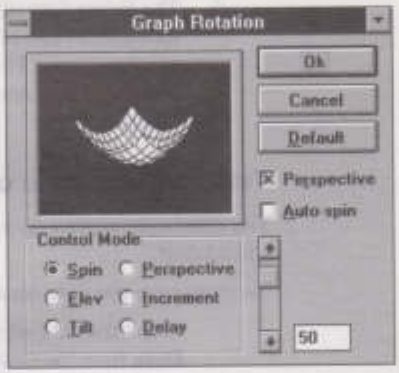
Rotating Graphs

Graphs can be rotated around any of the axes.

To rotate a graph:

1. Select the graph you want to rotate. Choose **Rotate Graph** from the Edit menu or click the Rotate Graph button located in the Analysis tool bar.

2. The Graph Rotation dialog box opens. When you find the angle you want to use, click OK to apply the new orientation to the selected graph. Use the Default button to return the graph to its original orientation.



The bitmap view of the graph in the display window rotates to show you what your graph will look like. You can rotate the graph manually using the slide bar to the right of the control mode area, or you can type in a number representing the number of degrees you want the graph to rotate. If you are using the Auto-spin option, the graph automatically spins around its Z axis. To stop the graph from spinning, click Auto-spin again.

Control Mode

Spin	Permits entry of the number of degrees of rotation around the Z-axis.
Elevation	Permits entry of the number of degrees of rotation around the Y-axis of the viewing plane.
Tilt	Permits entry of the number of degrees of rotation around the X-axis of the viewing plane.
Perspective	Permits entry of perspective depth in units. The smaller the number, the more exaggerated the perspective is.
Increment	Permits entry of the number of degrees for each auto-spin rotation.

Delay	Permits entry of auto-spin rotation timing in tenths of a second.

Other Options

Perspective	Selects rotation in perspective view. If de selected, rotation is performed without perspective adjustment.
Auto-spin	Animates graph rotation using the specified Control Mode settings. De selecting auto-spin freezes the graph at its current orientation.

Creating Combination Graphs

Harvard ChartXL allows you to create graphs that contain data from multiple spreadsheets or in multiple formats (such as a Column Chart with a Line Chart added). This gives you a powerful tool for creating useful and meaningful graphs. The Add Data function gives you the ability to plot several data sets that have very different ranges by adding and scaling multiple axes.

Note: If you want to have multiple axes on a single graph with each axis using a different scale, you must use the Add Data command. Each data set can be assigned to one set of axes. You can use the Add Data command to add several data sets from the same or different spreadsheets. See *Adding a Data Set* in **The Basics**.

Working with Graphics and Text Annotations

Overview of Working with Graphics and Text Annotation

To enhance the appearance of a graph, you can add a backdrop, text objects (called captions or annotations), and graphical objects.

You can type or import text. After you add text, you can change its font characteristics and other attributes.

You can import or paste graphical objects into Harvard ChartXL, use OLE to embed and link objects, or draw objects in Harvard ChartXL.

You can work with text blocks and graphical objects similarly (selecting, cutting and pasting, rotating, changing color, and so on). The zoom feature makes formatting easier.

You can export Harvard ChartXL graphs in several formats.

For information on selecting objects, see *Selecting, Moving, and Resizing* in **The Basics**.

Adding a Backdrop

Add a color backdrop to a page at any time. The default backdrop is a blue rectangle that fills the page, but you can change the fill color or pattern. The backdrop is always the bottom layer on a page.

To add a backdrop:

Choose **Backdrop** from the Insert menu.

To change the fill color or pattern:

Select the backdrop and choose **Fill** from the Format menu. In the Object Fill dialog box, select the options you want.

See *Formatting a Graph Frame* and *Changing the Color Scheme* in **Working with Graphs.**

To delete a backdrop from a page:

Select the backdrop and choose **Clear** from the Edit menu.

Adding Caption Text

Add captions to annotate your graphs and pages. You can format captions in different ways.

Creating a Caption

1. Choose **Caption** from the Insert menu or click the Caption button.

2. Click where you want to place the text and type.

   You can set tabs or insert Greek or mathematical characters by using special text tools. Choose these items from the View menu after you click where you want the text. Choose the item on the menu again to turn off the special ruler or character set.

Text Ruler	Opens a ruler you can use to place tab settings for your text.
Greek Symbols	Opens a set of Greek characters at the bottom of the screen. Click the character that you want to insert in your text block.

Math Symbols	Opens a set of mathematical symbols at the bottom of the screen. Click the symbol you want to insert in your text block.

3. When you finish typing text, click any place outside the text block.

Importing Text

You can import text files in either .RTF format or ASCII (.TXT) format. You work with the text as a text block after importing it.

To import text into a page:

Choose **Text File** from the Insert menu. In the Open dialog box, select the file type and file you want to import and click OK.

Editing a Caption

Once you've created a text caption, you can edit it as needed.

To edit a caption:

Double-click the text block to select it. Select the text you wish to edit. Cut, copy, and paste using the Windows clipboard. When you finish editing, click anywhere on the page to leave the text editing mode.

Formatting Captions and Other Text Objects

You can set text characteristics (such as font size or style) for entire text blocks or selected text within a block.

You can also enhance caption text by changing its color, enclosing it in a frame that you can fill, and adding other special effects.

In addition to text annotations that you add with the caption tool, you can select and format many other text objects, such as axis titles and data labels.

Note: To set default font characteristics for captions, see *Setting Program Options* in **The Basics**.

For information on selecting objects, see *Selecting, Moving, and Resizing* in **The Basics**.

Changing Text Color, Font Characteristics, and Alignment

To select characters within a block of text, double-click the block and select the text.

To change text color:

1. Select the text block or characters and choose **Color** from the Format menu.
2. In the Color Selection dialog box, choose a color and click OK to apply the new colors to the selected text.

See *Formatting a Graph Frame* and *Changing the Color Scheme* in **Working with Graphs**.

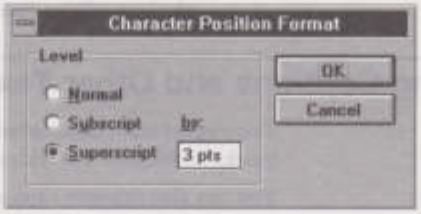
To change the font characteristics of a text block:

1. Select the text block or characters and choose **Character** from the Format menu.
2. In the Font dialog box, choose the options you want and click OK.

See *Choosing Font Characteristics* in **Working with Spreadsheets**.

To create superscripts and subscripts:

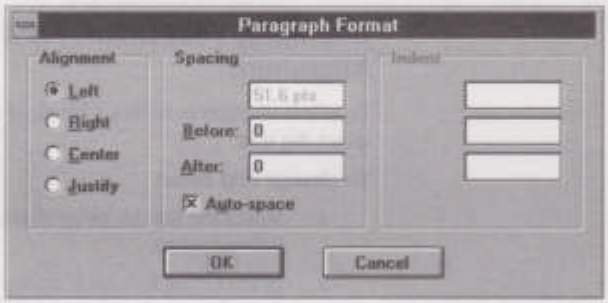
1. Select the text block and the characters you want to format. Choose **Position** from the Format menu.
2. In the Character Position Format dialog box, select subscript or superscript and set the number of points you want the selected character(s) to move up or down.



3. Click OK to apply the subscript or superscript. The size of the font is not changed, only its position in the line of text.

To align text in a caption:

1. Select the text block and choose **Paragraph** from the Format menu.
2. In the Paragraph Format dialog box, select the settings you want and click OK to apply the changes.



Left	The first characters of each line of text are aligned at the left side of the text block.
Right	The last characters of each line of text are aligned at the right side of the text block.
Center	Each line of text is centered within the text block.
Justify	Each line of text is spaced to fill the text block.
Spacing	Use this section to set the spacing between the lines of text in a text block.

Adding a Frame to a Caption

Select the text block and choose **Frame Style** from the Format menu. Click the frame style you want to apply.

See *Editing Frame Styles and Line Styles* in **Working with Graphs**.

Editing the Line Style of a Caption Frame

Select a caption and choose **Line Style** from the Format menu. In the Line Style Designer dialog box, choose the options you want and click OK.

See *Editing Frame Styles and Line Styles* in **Working with Graphs**.

Adding a Fill to a Text Block

To add a fill to the area around a text block:

1. Select the caption and choose **Color** from the Format menu.
2. In the Color Selection dialog box, click Fill and select a color for the fill.
3. Click OK.

To add a pattern or gradient fill to a frame:

1. Select the caption and choose **Fill** from the Format menu.
2. In the Object Fill dialog box, select the kind of fill you want.
3. Click OK.

See *Selecting Fill Colors and Patterns* in **Working with Graphs.**

Adding a Drop Shadow Effect

The Drop Shadow command applies a 3-D look and shadow to a caption. The colors can be changed using the Text and Shadow options in the Color Selection dialog box.

To add a drop shadow effect:

Select the caption and choose **Drop Shadow** from the Format menu.

Making Labels and Captions More Visible

The Transparent command is useful in formatting captions, axis labels, and data labels for visibility against dark or similar backgrounds.

To make captions or labels more visible:

Select the caption or label and choose **Transparent** from the Format menu to turn it off.

Rotating Text

To rotate a caption:

Select the text block. Eight selection handles appear around the caption, with a ninth handle placed off to the right. The cursor changes to a rotation cursor as it moves over this ninth handle. Drag the handle to rotate the caption. The original angle of the caption and the current rotation appears, in degrees, at the lower right of your screen as you rotate the text.

Adding Graphical Objects

You can add graphical objects to a page by importing images, pasting them, inserting OLE objects, and drawing objects in Harvard ChartXL.

Importing Clipart Images

To import clipart images:

Choose **Picture** from the Insert menu. In the Import Picture dialog box, select the file type and filename you want to import and click OK.

Harvard ChartXL can import picture files in the following formats:

BMP, DIB	Windows bitmap images
CGM, CTM	ANSI Computer Graphics Metafile images
DRW	Micrografx Drawing
DXF	AutoCAD Drawing
GIF	Compuserve images
CH3, SY3	Harvard Graphics DOS images
HGL	Hewlett-Packard HPGL images
PCX	PC Paintbrush Bitmap images
AI	Adobe Illustrator images
EPS	Encapsulated Postscript
TIF	Tagged Image Format
WMF	Windows metafile images

Copying, Cutting, and Pasting Objects

Selected objects can be moved or copied and pasted into the same Harvard ChartXL file, a new file, or into any other Windows program using the Windows clipboard.

To copy a selected object or group of objects:

Select the object(s). Choose **Copy** from the Edit menu or click the Copy button. A copy of the selection is placed in the Windows clipboard.

To cut a selected object or group of objects:

Select the object(s). Choose **Cut** from the Edit menu or click the Cut button. The selected object is deleted and placed in the Windows clipboard.

To paste an object from the clipboard:

Cut or copy the graphic object you want to paste. Then switch to the Harvard ChartXL page where you want to paste it and choose **Paste** from the Edit menu, or click the Paste button.

Note: You can choose **Undo** from the Edit menu or click the Undo button to reverse a clipboard action.

Inserting Objects Using OLE

You can link or embed an object using OLE (Object Linking and Embedding). OLE objects can be pictures, sound files, or other enhancements such as animated movie clips. After you've linked or embedded an OLE object in Harvard ChartXL, you can open the object's server (source) application to edit the object by simply double-clicking it.

Embedded objects become part of a Harvard ChartXL file. A linked object retains a connection to the server (source) document. Linked objects can be automatically updated when the source document changes.

To embed an OLE object:

1. Choose **Object** from the Insert menu. The Insert Object dialog box opens with a list of all the OLE server applications installed on your computer.
2. Select the type of object you want to insert and click OK.
3. The server application will open, allowing you to create or open the file for the object.
4. When the object is ready to insert into Harvard ChartXL, choose a command such as Update in the server application. Then choose a command such as Close and Return or Exit to return to Harvard ChartXL.

To link an OLE object:

1. In the server application, create the object you want to use in Harvard ChartXL. Save the file and select and copy the object to the clipboard. Don't close the file.
2. In the Harvard ChartXL Main window, choose **Paste Special** from the Edit menu.
3. In the Paste Special dialog box, select the object type that you just saved and copied to the clipboard.
4. Click Paste Link and close the dialog box.

Drawing Graphic Objects

You can create simple graphic annotations in Harvard ChartXL to enhance your graphs and pages. Add lines, rectangles, circles, and other geometric shapes to accentuate your data.

To create a graphic annotation:

1. Open the Insert menu and choose the type of annotation you want to create. Click on the page to begin drawing the selected shape.
2. Or, click the button in the Drawing Tool Bar for the shape you want to create. Click on the page to begin drawing the selected shape.

Drawing an Arc

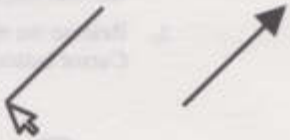
ARC

1. Place the pointer where you want to start the radius for the circle which will define the arc.
2. Press and hold the mouse button. Drag the pointer to the desired arc location. Note that the greater the radius length, the larger the implicit circle and the more oblique the arc.
3. Release the mouse button and drag the pointer to indicate the desired arc length. When the correct length is displayed, click again to set the arc end. To turn off the Arc tool, click the Cursor button in the Drawing Tool Bar.

Drawing an Arrow

ARROW

1. Place the pointer where you want the arrow head to appear.
2. Press and hold the mouse button. Drag the pointer to the end point for the arrow.
3. Release the mouse button.
4. You can double-click on the arrow to display the Arrow Style dialog box. This allows you to change the arrow head size and style. To turn off the Arrow tool, click the Cursor button in the Drawing Tool Bar.



Drawing a Bezier Curve

BEZIER

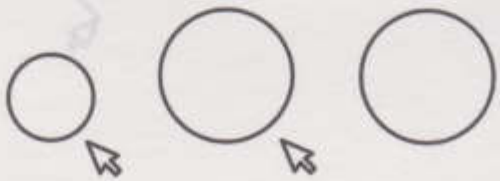
1. Place the pointer where you want the starting point for the first part of the curve.
2. Press and hold the mouse button. Drag the pointer to where you want the beginning of the second part of the curve. Release the mouse button.
3. Drag the pointer to the desired end point of the curve and click the mouse button to complete the curve. To turn off the Bezier tool, click the Cursor button in the Drawing Tool Bar. A Bezier curve has handles at each point where you clicked to start a new part of the curve. Use these handles to adjust the shape of the curve.

Drawing a Circle

CIRCLE

To create a perfect circle, draw a circle, select it, and choose **Size** from the Arrange menu. Set the X and Y dimensions to be equal.

1. Place the pointer where you want to create a circle.
2. Press and hold the mouse button. Drag the pointer to create the size and shape of circle you want
3. Release the mouse button. To turn off the Circle tool, click the Cursor button in the Drawing Tool Bar.



Drawing a Line

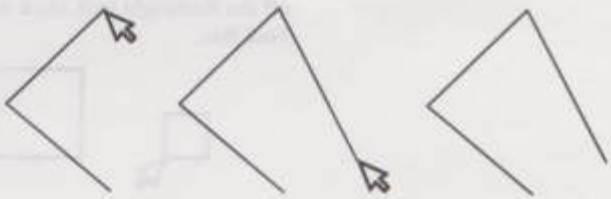
LINE

1. Place the pointer where you want the line to begin.
2. Press and hold the mouse button. Drag the pointer to where you want the end point for the line.
3. Release the mouse button.
4. You can double-click on the line to display the Arrow Style dialog box. This allows you to change the line style to an arrow, if desired. To turn off the Line tool, click the Cursor button in the Drawing Tool Bar.

Drawing a Poly-line

POLY-LINE

1. Place the pointer where you want to start the poly-line.
2. Press and hold the mouse button. Drag the pointer to the desired end point for the first segment of the poly-line. Release the mouse button and drag the pointer to the desired end point for the second segment of the poly-line.
3. For each succeeding segment, click the mouse button and drag the pointer to the segment end point. When the poly-line is complete, click the right mouse button. To turn off the Poly-line tool, click the Cursor button in the Drawing Tool Bar.



Drawing a Polygon

POLYGON

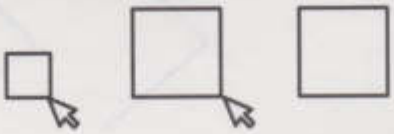
1. Place the pointer where you want to start the polygon.
2. Press and hold the mouse button. Drag the pointer to the desired end point for the first polygon segment. Release the mouse button and drag the pointer to the desired end point for the second polygon segment.
3. For each succeeding segment, click the mouse button and drag the pointer to the segment end point. To close the polygon, click the right mouse button. To turn off the Polygon tool, click the Cursor button in the Drawing Tool Bar.

Drawing a Rectangle

RECTANGLE

To create a square, first draw a rectangle, select it, choose **Size** from the Arrange menu, and set the X and Y dimensions to be equal.

1. Place the pointer where you want to start the rectangle.
2. Press and hold the mouse button. Drag the pointer to create a rectangle of the desired size. Release the mouse button. To turn off the Rectangle tool, click the Cursor button in the Drawing Tool Bar.



Drawing a Wedge

WEDGE

1. Place the pointer where you want to start the radius for the circle which will define the wedge.
2. Press and hold the mouse button. Drag the pointer to the desired arc location. Note that the greater the radius length, the larger the wedge.
3. Release the mouse button and drag the pointer to indicate the desired wedge width. When the correct length is displayed, click again to set the wedge end. To turn off the Wedge tool, click the Cursor button in the Drawing Tool Bar.

Formatting Graphic Objects

Clipart images and OLE objects can be moved and resized. For information, see *Selecting, Moving, and Resizing* in **The Basics**.

Graphics that you create using the drawing tools can be formatted like other objects in Harvard ChartXL. You can add frames and fills, change their color, and set the color and styles of the lines that frame them. See *Formatting Captions and Other Text Objects* for more about formatting graphic objects.

Setting the Drawing Order of Multiple Objects on a Page

Objects are layered on your page based on the order in which they were added. When Harvard ChartXL redraws a page, the object that is in the back redraws first and other objects are redrawn in the order in which they were placed on the screen. If you are trying to edit an object that was placed last, all the other objects must redraw before you get to the last one. This can be time consuming. Changing the drawing order can be used as a formatting tool.

To change the drawing order of multiple objects:

Select the object you want to move forward or backward in the drawing order. Open the Arrange menu. The four choices are described below:

Bring to Front	Sends the selected object to the front layer of the drawing order, causing it to be the last object drawn.
Send to Back	Sends the selected object to the back layer of the drawing order, causing it to be the first object drawn.
Move Forward	Sends the selected object forward one layer in the drawing order.
Move Backward	Sends the selected object backward one layer in the drawing order.

To redraw the screen:

Choose **Redraw** from the Window menu or click the Redraw button. The objects on the current page are redrawn.

To interrupt a screen redraw:

Click the Halt Redraw button.

Note: Objects can be selected and edited, even if you've halted the redraw before you can see them. Use the Tab key or the Up and Down Arrow keys on your keyboard to select an object. The name of the selected object is displayed at the bottom of the screen. All the menu commands are available for the selected object.

Using the Zoom Feature

You can zoom in on any section of the graph page. This does not affect the size of objects, just your view of them.

The Zoom percentage refers to the percentage of the original view. 100% displays the object at its actual size.

To zoom in on an object:

1. Open the **View** menu and click on a percentage (for example, 33%, 50%). The page is redisplayed in the new size. The current zoom percentage is displayed in the zoom display area of the tool bar.
2. Or, click the Zoom button. The cursor becomes a magnifying glass. Hold down the mouse button and draw a box around the area that you want to zoom in on. When you release the mouse button, the area is enlarged.

3. Or, click the up and down arrows to the right of the zoom display area. The zoom percentage is changed in increments of 10%.

To cancel a zoom view:

Choose **Fit to Page** from the View menu or click the Fit to Page button.

Exporting Harvard ChartXL Graphs and Objects

Harvard ChartXL graphs and graphical objects can be exported in different formats. If you have multiple objects selected, they are exported as a single image file.

To export a Harvard ChartXL graph:

1. Select the graph(s) or object(s) you want to export. Choose **Export Picture** from the File menu.
2. In the Export Picture As dialog box, select a file type, name, and location.
3. Click OK to export the picture in the selected format.

Harvard ChartXL can export picture files in the following formats:

BMP	Windows bitmap images
TIF	Tagged Image Format
CGM	ANSI Computer Graphics Metafile images
EPS	Encapsulated Postscript
WMF	Windows metafile images

Note: For most export file types, except Windows metafile, a dialog box allows you to select output options. You control how the image is output, including some file compression options.

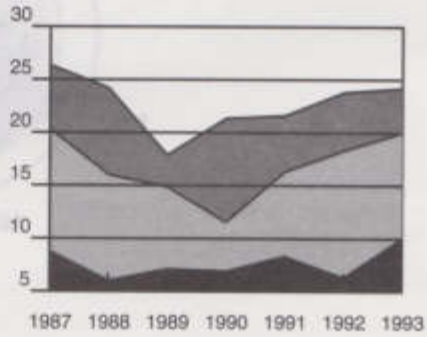
Business Graphs

Overview of Business Graphs

The Business Graph category contains graphs that are generally used for business applications, for example, displaying trends and comparisons. In **Business Graphs**, you'll find a brief description of each business graph, along with the Style dialog box, Range Highlighter, and a sample spreadsheet for the graph. Several of the graph types are similar in usage and share common Style dialog boxes and Range Highlighters. These similar graphs are grouped together for ease of explanation.

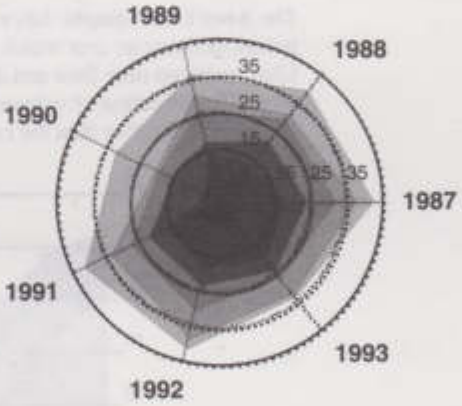
Area Charts, Line Charts and Spider Plots

The **Area Chart** graphs data as a series of line segments, connecting data points, defining an area which is filled. Like the Line Chart, the Area Chart suggests time flow and displays the relation of two variables over time. The indication of volume beneath the line highlights the magnitude of the change rather than the rate of change.



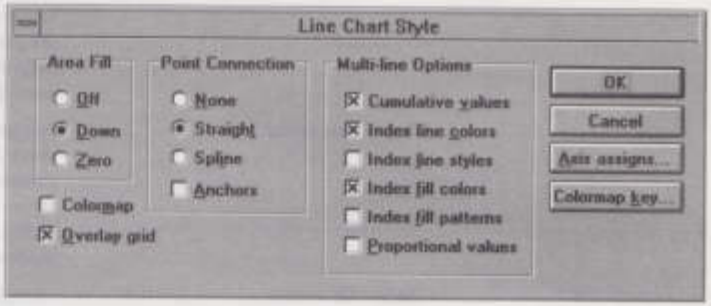
The **Line Chart** plots data as a series of line segments connecting the chart data points. The running line that results naturally suggests flow. This makes the Line Chart particularly suitable for displaying the changing behavior of data over time. For this reason, the Line Chart is sometimes called a Time Series Plot or a Run Chart.

The **Spider Plot** displays a number of separate scores or values for a category. The center of the plot is the minimum value and the outer diameter is the maximum value. This graph type is used to identify non-conformity within the category.



Setting Styles for Area Charts, Line Charts and Spider Plots

The Line Chart Style dialog box contains display options for the selected graph. The Area Chart, Line Chart and Spider Plot use this dialog box.



Area Fill

Off — Deselects Area Fill. Converts an Area Chart to a Line Chart with cumulative values.

Down — Adds a color or pattern fill that goes from the curve to the X-axis border. Converts a Line Chart to an Area Chart without cumulative values.

Zero — Adds a color or pattern fill from the curve to zero on the value axis (Y-axis). Highlights deviation of values from zero. Converts a Line Chart to an Area Chart without cumulative values.

Point Connection

None — Displays graph data points only, with no connecting curve.

Straight — Draws a straight line between the data points.

Spline — Draws a smooth curve passing through all data points.

Anchors — Draws a line from each graph data point to the border at the X-axis.

Multi-line Options

Cumulative values
Stacks the values for successive lines. This is important for Area Charts so that information is not hidden.

Index line colors
Assigns a different line color to each curve in a plotted data series containing multiple curves. The colors are pre-defined. To change an individual line color, choose **Color** from the Format menu.

Index line styles
Assigns a different line style to each curve in a plotted data series containing multiple curves. The line styles are pre-defined. To change an individual line style, choose **Line Style** from the Format menu.

Index fill colors
Assigns a different fill color to each curve in a plotted data series containing multiple curves. The colors are pre-defined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns
Assigns a different fill pattern to each curve in a plotted data series containing multiple curves. The fill patterns are pre-defined. To change an individual fill pattern, choose **Fill** from the Format menu..

Proportional values
Positions each point in a vertical grouping of lines as a percentage of the group total.

Other Options

Colormap
Assigns colors to a range of graph values in accordance with the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Overlay grid
Displays the major and minor axis grids on top of all other graph elements.

Range Highlighter for Area Charts, Line Charts and Spider Plots

The Area Chart, Line Chart and Spider Plot share a common Range Highlighter and default spreadsheet layout. The Range Highlighter for these graphs allows you to view and/or specify five spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1

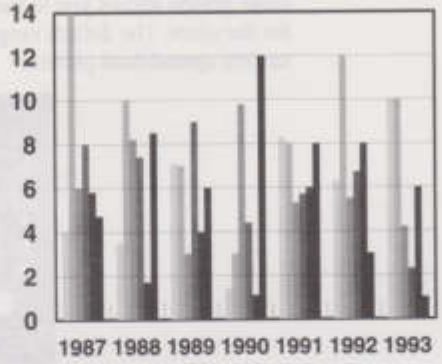
T1	A	B	C	D
1		Region 1	Region 2	Region 3
2	1987	4	14	6
3	1988	3.5	10	8.2
4	1989	7.1	7	3
5	1990	1.4	3	9.8
6	1991	8.3	8	5.3
7	1992	6.3	12	5.5

Default Ranges for Area Charts, Line Charts and Spider Plots

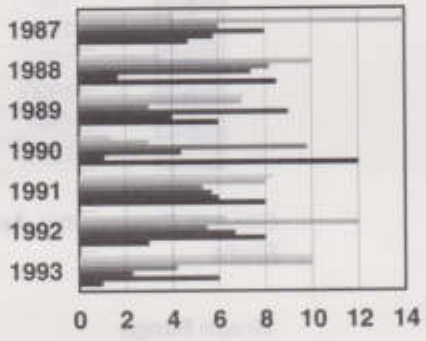
Graph Range	Default Location
Axis Labels	All cells in the A column, beginning in cell A2.
Data Values	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Color-Coding	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Legend Labels	All cells in the first row, beginning in cell B1.

Bar Charts and Column Charts

The **Column Chart** shows changes in values over time or relative comparison of values. It is best suited to time series comparison.

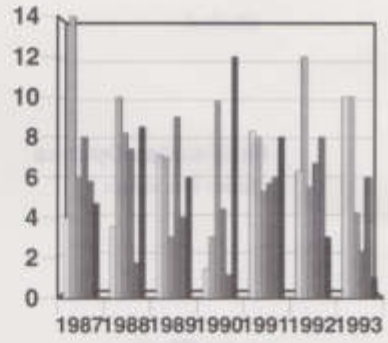


The **Bar Chart** is similar to the Column Chart, but compares several items at a specific point in time. The horizontal axis shows the amount or percentage of each item.



The **3-D Bar Chart** compares several items at a specific point in time. The horizontal axis shows the amount or percent of each item.

Harvard ChartXL also provides front-facing and oblique forms of **3-D Column Charts**.



For both Bar Charts and front-facing Column Charts, the 3-D perspective is added for visual effect and does not represent an additional data value.

Setting Styles for Bar Charts and Column Charts

The Bar Chart Style dialog box contains display options for the selected graph. The Bar Chart, Column Chart, 3-D Bar Chart and both forms of the 3-D Column Chart use this dialog box.

Graph Format

2-D	Displays the selected graph as a 2-D graph.
3-D x-y	Displays Bar graphs as 3-D graphs, and Column Charts as front-facing 3-D graphs.
3-D x-y-z	Displays Column Charts as oblique 3-D graphs.

Bar Grouping

Adjacent — Displays the bars or columns side by side.

Overlapping — Displays the bars or columns overlapping each other.

Stacked — Displays the bars or columns as stacks, allowing you to view cumulative or proportional data.

Multi-series Options

Index line colors — Assigns a different line color to each series of bars or columns in a graph containing multiple series. The colors are pre-defined. To change an individual line color, choose **Color** from the Format menu

Index fill colors — Assigns a different fill color to each series of bars or columns in a graph containing multiple series. The colors are pre-defined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns — Assigns a different fill pattern to each series of bars or columns in a graph containing multiple series. The fill patterns are pre-defined. To change an individual fill pattern, choose **Fill** from the Format menu.

Options

Horizontal — If checked, displays the data as bars. If not checked, displays the data as columns.

Proportional — If multiple series are being plotted, displays each series as a percentage of the total for all series. Data is displayed stacked with the height of each column (or the length of each bar) representing the total.

Use 2-D fonts — Displays axis labels as horizontal non-rotated text.

Overlay grid — Draws the major and minor grid lines on top of all other graph elements.

Group Dimensions

Width — Sets the width dimensions for bars or columns. Maximum width is 100, minimum is 0.

Depth — Sets the depth dimension for 3-D bars or columns. Maximum depth is 100, minimum is 0.

Range Highlighter for 2-D Bar Charts and Column Charts

Bar Charts and Columns Charts share a common default spreadsheet layout and similar Range Highlighters. The Range Highlighter for 2-D Bar Charts and Column Charts allows you to view and/or specify four spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1	A	B	C	D	E
1	0	Region 1	Region 2	Region 3	Region 4
2	1987	8.77917	11.5354	6	8
3	1988	6	10	8.2	7.4
4	1989	7.1	7.75	3	9
5	1990	6.8875	4.66667	9.8	4.4

Default Ranges for 2-D Bar Charts and Column Charts

Graph Range	Default Location
Axis Labels	All cells in the A column, beginning in cell A2.
Bar Values	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Legend Labels	All cells in the first row, beginning in cell B1.

Range Highlighter for 3-D Bar Charts and Front-Facing Column Charts

The Range Highlighter for 3-D Bar Charts and 3-D front-facing Column Charts allows you to view and/or specify four spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

TI	A	B	C	D	E
1	0	Region 1	Region 2	Region 3	Region 4
2	1987	8.77917	11.5354	6	8
3	1988	6	10	8.2	7.4
4	1989	7.1	7.75	3	9
5	1990	6.8875	4.66667	9.8	4.4

Default Ranges for 3-D Bar Charts and Front-Facing Column Charts

Graph Range	Default Location
Axis Labels	All cells in the A column, beginning in cell A2.
Legend Labels	All cells in the first row, beginning in cell B1.
Bar Values	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.

Range Highlighter for 3-D Oblique Column Charts

The Range Highlighter for 3-D oblique Column Charts allows you to view and/or specify four spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

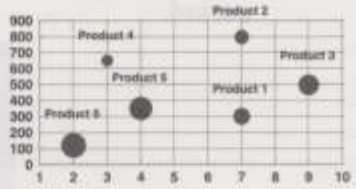
T1	A	B	C	D	E
1		Region 1	Region 2	Region 3	Region 4
2	1987	8.77917	11.5354	6	8
3	1988	6	10	8.2	7.4
4	1989	7.1	7.75	3	9
5	1990	6.8875	4.66667	9.8	4.4

Default Ranges for 3-D Oblique Column Charts

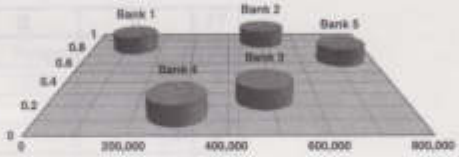
Graph Range	Default Location
X-Axis Labels	All cells in the A column, beginning in cell A2.
Y-Axis Labels	All cells in the first row, beginning in cell B1.
Bar Values	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.

Bubble Charts, Group Maps, and Pie-Bubble Charts

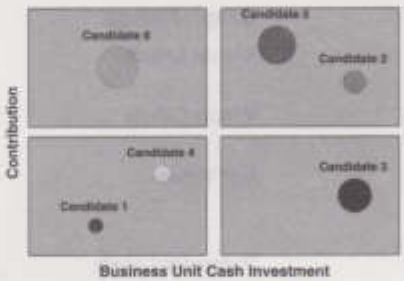
The **Bubble Chart** displays an X,Y location as well as the relative size of each item. It's frequently used in market and product comparison studies.



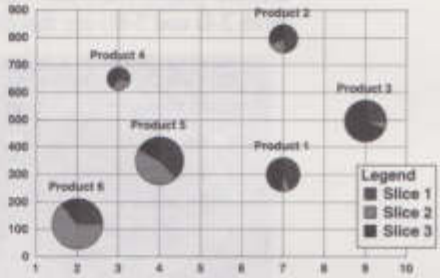
The **3-D Bubble Chart** is the same as the 2-D Bubble Chart, but adds a 3-D effect to the display of the graph.



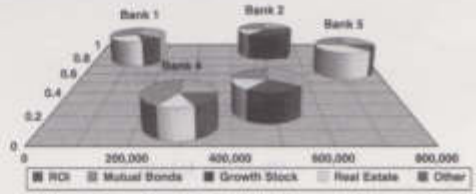
The **Group Map** displays the relative size of each item and position within four distinct quadrants.



The **Pie-Bubble Chart** displays X and Y location plus an additional variable of bubble size. Each bubble is then subdivided into individual pie slice components. It can be used to display Bubble Chart data in finer detail.



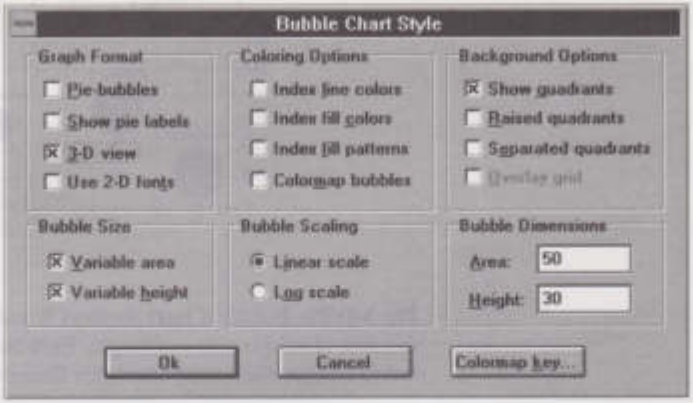
The **3-D Pie-Bubble Chart** displays X and Y location plus the added variable of bubble size and height. Each bubble is subdivided into individual pie-slice components for finer detail.



Note: When using the Pie-Bubble Chart you will find some new options under the Format menu. Select the graph by clicking on it. You can control the Slice Separation and Data Labels for selected slices from the Format menu.

Setting Styles for Bubble Charts, Group Maps, and Pie-Bubble Charts

The Bubble Chart Style dialog box contains display options for the selected graph. The Bubble Chart, Group Map, and Pie-Bubble Chart (both 2-D and 3-D) use this dialog box.



Graph Format

Pie-Bubbles — Turns on the pie slice display for Pie-Bubble Charts.

Show pie labels — If displaying pie slices, adds a label to each pie-bubble.

3-D view — Adds a 3-D effect to Bubble Charts, Group Maps and Pie-Bubble Charts.

Use 2-D fonts — Displays axis labels as horizontal non-rotated text.

Bubble Size

Variable Area — If selected, uses the Area Value range in the spreadsheet to define the area of the bubbles.

Variable Height — If selected, uses the Height Value range in the spreadsheet to define the area of 3-D bubbles.

Coloring Options

Index line colors — Assigns a different line color to each bubble. The colors are pre-defined. To change an individual line color, choose **Color** from the Format menu.

Index fill colors — Assigns a different fill color to each bubble or pie slice. The colors are pre-defined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns	Assigns a different fill pattern to each bubble or pie slice. The fill patterns are pre-defined. To change an individual fill pattern, choose **Fill** from the Format menu.
Colormap bubbles	Assigns colors to the bubbles, based on the range of data that was defined as Color Coding in the spreadsheet. The colormap options can be changed by clicking the Colormap key button.

Bubble Scaling

Linear scale	Applies linear scaling to the bubble area and height (if 3-D).
Log scale	Applies log scaling to the bubble area and height (if 3-D).

Background Options

Show quadrants	Converts a Bubble Chart to a Group Map. Converts a 3-D Bubble Chart to a 3-D Group Map.
Raised quadrants	If quadrants are shown, displays the quadrants as raised and places a shadow underneath.
Separated quadrants	If quadrants are shown, displays the quadrants as discrete sections.
Overlay grid	Displays the major and minor axis grids on top of all other graph elements.

Bubble Dimensions

Area	Accepts entry of a maximum value relative to which bubble area is scaled.
Height	Accepts entry of a maximum value relative to which bubble height is scaled.

Range Highlighter for Bubble Charts and Group Maps

The Range Highlighter for 2-D or 3-D Bubble Charts and Group Maps allows you to view and/or specify six spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1

T1	A	B	C	D
1	Label	Horizontal	Vertical	Size
2	Product 1	7	299	1400
3	Product 2	7	795	1000
4	Product 3	9	495	2200
5	Product 4	3	649	650
6	Product 5	4	349	2850
7	Product 6	2	119	3200

Default Ranges for Bubble Charts and Group Maps

Graph Range	Default Location
Bubble Labels	All cells in the A column, beginning in cell A2.
X	All cells in the B column, beginning in cell B2.
Y	All cells in the C column, beginning in cell C2.
Area Value	All cells in the D column, beginning in cell D2.
Height Value	All cells in the E column, beginning in cell E2.
Color-Coding	All cells in the D column, beginning in cell D2.

Range Highlighter for Pie-Bubble Charts

The Range Highlighter for 2-D or 3-D Pie-Bubble Charts allows you to view and/or specify seven spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1

T1	A	B	C	D
1	Label	Horizontal	Vertical	Size
2	Product 1	7	299	1400
3	Product 2	7	795	1000
4	Product 3	9	495	2200
5	Product 4	3	649	650
6	Product 5	4	349	2850
7	Product 6	2	119	3200

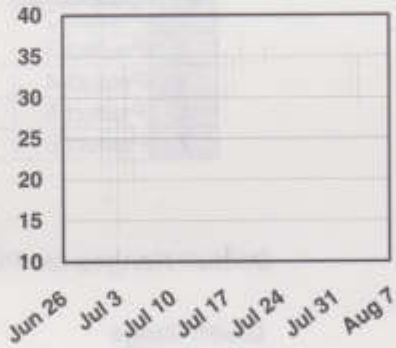
Default Ranges for Pie-Bubble Charts

Graph Range	Default Location
Pie Labels	All cells in the A column, beginning in cell A2.
X	All cells in the B column, beginning in cell B2.
Y	All cells in the C column, beginning in cell C2.
Area Value	All cells in the D column, beginning in cell D2.
Height Value	All cells in the D column, beginning in cell D2.
Slice Labels	All cells in the first row, beginning in cell E1.
Slice Values	All cells in the spreadsheet, beginning in cell E2 and moving down and to the right.

Candlestick Charts and Hi-Lo-Close Charts

The **Candlestick Chart** displays fluctuations in stock prices over time, including high, low, open, and close indicators. The open and close prices are displayed as columns to further highlight those values.

The **Hi-Lo-Close Chart** displays fluctuations in stock prices over time, including hi, lo, open, and close indicators.



Setting Styles for Candlestick Charts

The Candlestick Chart Style dialog box contains display options for the selected graph.

Options

Show hi-lo — Displays hi-lo indicators on the graph.

Overlay grid — Displays the major and minor axis grids on top of all other graph elements.

Symbol width — Specifies the width of horizontal open and close lines. The maximum width of 100 causes all horizontal and vertical lines to connect. Minimum width is 0.

Coloring

Uniform — Assigns the same color to all range bars in the chart.

Gain/loss — Uses two colors to distinguish gains and losses. When the opening value is higher than the closing value, that loss is given one color. When the closing value is higher than the opening value, that gain is given another color.

Colormap — Assigns colors to a range of graph values in accordance with the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Setting Styles for Hi-Lo-Close Charts

The Hi-Lo-Close Chart Style dialog box contains display options for the selected graph.

Options

Show open — Displays the opening value as a horizontal line joining the vertical range line from the left.

Show close — Displays the closing value as a horizontal line joining the vertical range line from the right.

Overlay grid — Displays the major and minor axis grids on top of all other graph elements.

Symbol width — Specifies the width of horizontal open and close lines. The maximum width of 100 causes all horizontal and vertical lines to connect. Minimum width is 0.

Coloring

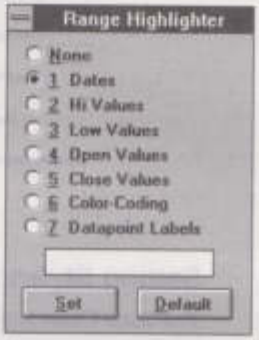
Uniform — Assigns the same color to all range bars in the chart.

Gain/loss — Uses two colors to distinguish gains and losses. When the opening value is higher than the closing value, that loss is given one color. When the closing value is higher than the opening value, that gain is given another color.

Colormap — Assigns colors to a range of graph values in accordance with the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Range Highlighter for Candlestick Charts and Hi-Lo-Close Charts

The Range Highlighter for Candlestick Charts and Hi-Lo-Close Charts allows you to view and/or specify seven spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.



T1

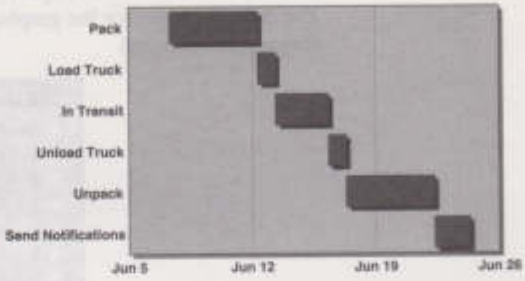
T1	A	B	C	D	E
1		High	Low	Open	Close
2	34513	32	20	29	26
3	34514	31	17	26	24
4	34515	28	14	24	27
5	34516	34	21	27	26
6	34517	27	18	26	22
7	34520	24	14	22	17
8	34521	22	12	17	18
9	34522	24.5	15.2	18	19

Default Ranges for Candlestick Charts and Hi-Lo-Close Charts

Graph Range	Default Location
Dates	All cells in the A column, beginning in cell A2.
Hi Values	All cells in the B column, beginning in cell B2.
Lo Values	All cells in the C column, beginning in cell C2.
Open Values	All cells in the D column, beginning in cell D2.
Close Value	All cells in the E column, beginning in cell E2.
Color-Coding	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Datapoint Labels	All cells in the A column, beginning in cell A2.

Gantt Charts

The **Gantt Chart** displays range bars which indicate the relative time required for various activities within a project.



Setting Styles for Gantt Charts

The Gantt Chart Style dialog box contains display options for the selected graph.

Options

Overlay grid

Displays the major and minor axis grids on top of all other graph elements.

Group Width

Specifies the bar width. The maximum width of 100 places the bars immediately adjacent to one another with no intervening space. Minimum width is 0.

Range Highlighter for Gantt Charts

The Range Highlighter for Gantt Charts allows you to view and/or specify five spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1

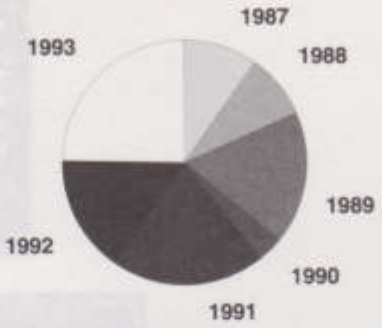
T1	A	B	C
1	Task	Start Time	Duration
2	Pack	34492.3	5
3	Load Truck	34497.3	1
4	In Transit	34498.3	3
5	Unload Truck	34501.3	1
6	Unpack	34502.3	5
7	Send Notific	34507.3	2

Default Ranges for Gantt Charts

Graph Range	Default Location
Task Description	All cells in the A column, beginning in cell A2.
Start Time	All cells in the B column, beginning in cell B2.
Duration	All cells in the spreadsheet, beginning in cell C2 and excluding the first row and columns A and B.
Datapoint Labels	All cells in the D column, beginning in cell D2.
Legend Labels	All cells in the first row, beginning in cell C1.

Pie Charts

The **Pie Chart** graphs data as a proportional slice of a circular pie. The resulting chart is useful in the comparison of relative contributions of parts to a whole.

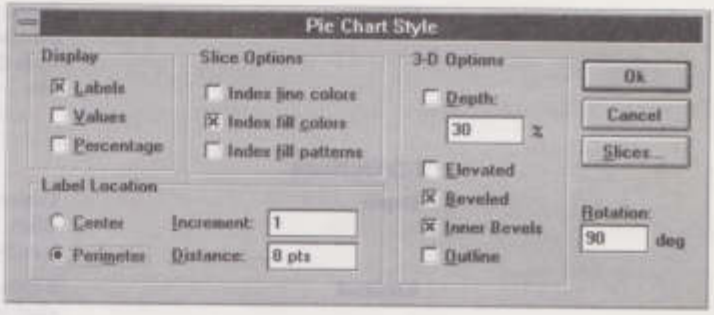


The **3-D Pie Chart** graphs data as a proportional slice of a three dimensional pie. The resulting chart is useful in the comparison of relative contributions of parts to a whole.

Note: When using the Pie Chart you will find some new options under the Format menu. Select the graph by clicking on it. You can control the Slice Separation and Data Labels for selected slices from the Format menu.

Setting Styles for Pie Charts

The Pie Chart Style dialog box contains display options for the selected graph.



Display

Labels — Displays the label for each slice as defined in the spreadsheet with the Range Highlighter.

Values — Displays the value for each slice.

Percentage — Displays the value of each slice as a percentage of the pie total.

Slice Options

Index line colors — Assigns a different line color to each slice. The colors are pre-defined. To change the line color for an individual slice, choose **Color** from the Format menu.

Index fill colors — Assigns a different fill color to each pie slice. The colors are pre-defined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns — Assigns a different fill pattern to each pie slice. The fill patterns are pre-defined. To change an individual fill pattern, choose **Fill** from the Format menu.

Label Location

Center — Displays slice labels, values, and/or percentages at the center of each slice.

Perimeter — Displays slice labels, values, and/or percentages at the perimeter of each slice.

Increment Determines the interval at which labels are displayed. For example, an entry of 3 displays every third label after the first.

Distance Displays slice labels, values, and/or percentages to a distance in points from the center or perimeter of the pie.

3-D Options

Depth Converts a 2-D Pie Chart to a 3-D Pie Chart. Use the percentage box to specify the thickness of the pie.

Elevated Elevates the entire pie and places a shadow below it.

Beveled Adds a beveled effect to the outer edges of the pie.

Inner Bevels Adds a beveled effect to the inner edges of the pie.

Outline Removes the fill from the pie, leaving an outline only.

Other Options

Rotation Rotates the Pie Chart by the specified number of degrees.

Slices Opens the Pie Slice Style dialog box. This dialog box allows you to apply formatting to individual pie slices.

Slice Label Click a slice label to select it for formatting.

Separation Set the percentage that the selected pie slice is separated from the rest of the pie.

3-D Options

Elevated	Elevates the selected pie slice above the rest of the pie.
Outline	Removes the fill from the selected pie slice, leaving just the outline.

Range Highlighter for Pie Charts

The Range Highlighter for Pie Charts allows you to view and/or specify three spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

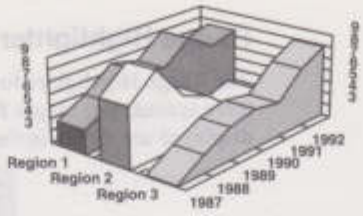
T1	A	B	C	D	E
1		Region 1	Region 2	Region 3	Region 4
2	1987	8.77817	11.5354	6	8
3	1988	9	10	8.2	7.4
4	1989	7.1	7.75	3	5
5	1990	6.8675	4.66667	9.8	4.4

Default Ranges for Pie Charts

Graph Range	Default Location
Slice Labels	All cells in the A column, beginning in cell A2.
Slice Values	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and column A.
Legend Labels	All cells in the first row, beginning in cell B1.

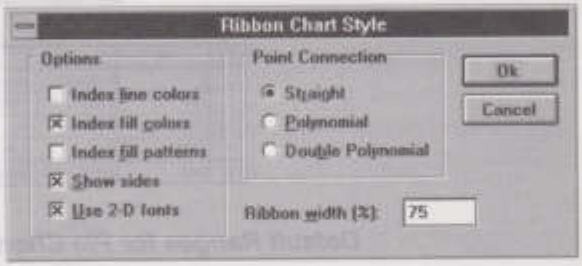
Ribbon Charts

The **3-D Ribbon Chart** displays trends of several categories over a continuous period of time.



Setting Styles for Ribbon Charts

The Ribbon Chart Style dialog box contains display options for the selected graph.



Options

Index line colors — Assigns a different line color to ribbon. The colors are pre-defined. To change an individual line color, choose **Color** from the Format menu.

Index fill colors — Assigns a different fill color to each ribbon. The colors are pre-defined. To change an individual fill color, choose **Color** from the Format menu..

Index fill patterns — Assigns a different fill pattern to each ribbon. The fill patterns are pre-defined. To change an individual fill pattern, choose **Fill** from the Format menu.

Use 2-D fonts — Displays axis labels as horizontal non-rotated text.

Point Connection

Straight

Connects the points on the graph with straight lines, making sharp angles at the bends in the ribbon.

Polynomial

Connects the points on the graph with polynomial curves, making a smooth curve at the bends in the ribbon.

Double Polynomial

Connects the points on the graph with polynomial curves, making a smooth curve at the bends in the ribbon. Use this option for a smoother ribbon with many data points.

Other Options

Ribbon Width

Specifies the ribbon width. The maximum width of 100 places the ribbons immediately adjacent to one another with no intervening space. Minimum width is 0.

Range Highlighter for Ribbon Charts

The Range Highlighter for Ribbon Charts allows you to view and/or specify five spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1	A	B	C	D
1	0	Region 1	Region 2	Region 3
2	1987	4	7	2.1
3	1988	5.3	9	3.5
4	1989	7.1	6.1	4.7
5	1990	8.5	5.2	5.2

Default Ranges for Ribbon Charts

Graph Range	Default Location
X-Axis Labels	All cells in the A column, beginning in cell A2.
Y-Axis Values	All cells in the first row, beginning in cell B1.
Data Values	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Legend Labels	All cells in the first row, beginning in cell B1.

Table Charts

A **Table Chart** displays data values in a tabular format. It can be used to present spreadsheet data in an attractive and meaningful manner.

	Hurdles	400-Meter	100-Meter	Javelin
Mark K.	351	468	116	460
Steve K.	232	116	585	819
David U.	116	696	351	116
Chase F.	696	805	230	348
Tak S.	812	585	702	580

Note: When using the Table Chart you will find some new options under the Format menu. Select the graph by clicking on it. You can control the Row Height, Column Width and Character Alignment from the Format menu.

Setting Styles for Table Charts

The Table Chart Style dialog box contains display options for the selected graph.

Cell Options

Draw vertical lines	Draws vertical lines in the table.
Draw horizontal lines	Draws horizontal lines in the table.
Draw title separators	Draws lines separating the row and column headings.
Cell word wrap	Expands cell height to fit text.

Default Cell Dimensions

Column width	Shows the default cell width assigned to the Table Chart. Allows you to define a cell width.

Color Options

Index fill colors	Assigns a different pre-set color fill to the columns in the table.
Index fill patterns	Assigns a different pre-set fill pattern to the columns in the table.
Colormap fill	Assigns colors to a range of graph values in according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.
Alternate column fill	Applies fill options to alternate columns.
Alternate row fill	Applies fill options to alternate rows.

Range Highlighter for Table Charts

The Range Highlighter for Table Charts allows you to view and/or specify four spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1	A	B	C	D	E
1	0	Hurdles	400-Meter	100-Meter	Javelin
2	Mark K.	351	468	516	480
3	Steve K.	232	516	585	819
4	David U.	516	936	351	516
5	Chase F.	936	805	230	344

Default Ranges for Table Charts

Graph Range	Default Location
Row Labels	All cells in the A column, beginning in cell A2.
Column Labels	All cells in the first row, beginning in cell B1.
Data Values	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Color-Coding	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.

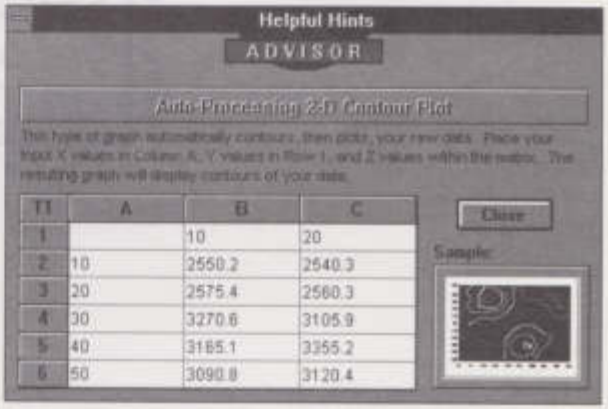
Technical Graphs

Overview of Technical Graphs

The Technical Graphs category consists of graphs suitable for technical applications, for example, surface graphs and graphs with curves. In **Technical Graphs**, you will find a brief description of each technical graph type, along with the Style dialog box, Range Highlighter, and a sample spreadsheet for each graph. Several of the graph types are similar in usage and share common Style dialog boxes and Range Highlighters. These related graphs are grouped together.

Two-dimensional Contour Plots, Shadow-Contour Plots and 3-D Surface Plots from Triplets are *automatic processing* graphs. When you select an automatic processing graph, the data in your input spreadsheet is processed and placed in a new output spreadsheet, which is used to plot the graph.

When you create a spreadsheet for an automatic processing graph, Harvard ChartXL displays the Advisor Helpful Hints dialog box to tell you how data will be processed by Harvard ChartXL.



TT	A	B	C
1		10	20
2	10	2550.2	2540.3
3	20	2575.4	2560.3
4	30	3270.6	3105.9
5	40	3165.1	3355.2
6	50	3090.8	3120.4

Automatic processing graphs also have a *no processing* option. You can choose that option to graph data that has already been processed.

You can use a special Harvard ChartXL feature, the Formula Solver, to generate equations and plot them on some types of technical graphs.

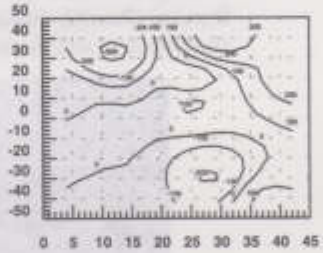
Contour Plots

These are the 2-D and 3-D contour plots and their uses.

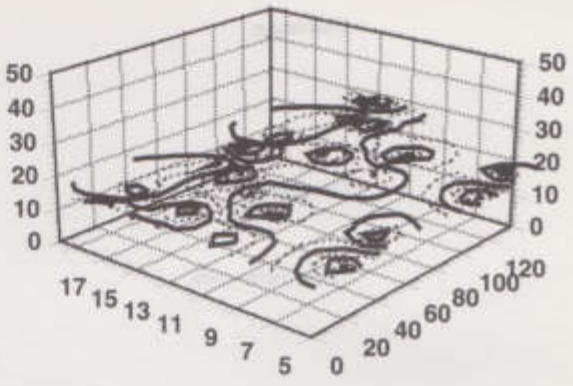
Contour Plot	Two-dimensional graph that creates a series of evenly spaced cross sections from a matrix of surface data and displays the resulting curves on an XY plot.
Contour Plot (no processing)	Plots data that has already been contoured. The data is displayed on a 2-dimensional graph as a series of contour curves, each defined by a series of XY points.
3-D Contour Plot from Curves	Plots data that has already been contoured.The data is displayed as a set of 3-dimensional contour curves, each defined by a set of XYZ triplets.
3-D Shadow-Contour Plot	Combines a Surface Plot with a 3-D Contour Plot whose contours are derived from the surface.

The **Contour Plot** is a 2-D automatic processing graph that is commonly used to display topographic data.

Select the **Contour Plot (no processing)** graph type to plot data that has already been processed.



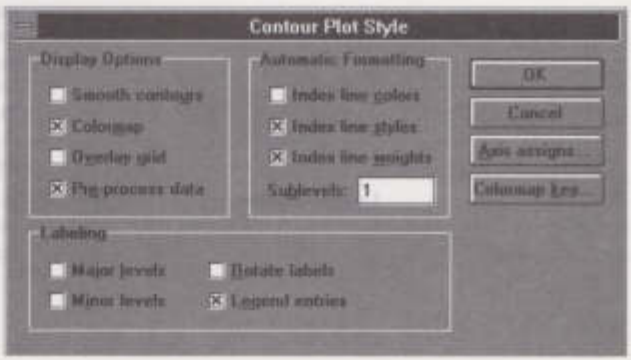
The **Contour Plot from curves** is a 3-D graph used to plot data that has already been contoured. The data is displayed in a format similar to the Shadow-Contour Plot, but with no Surface.



The **Shadow-Contour Plot** is a 3-D automatic processing graph.

Setting Styles for Contour Plots

The Contour Plot Style dialog contains display options for the selected graph.



Display Options

Smooth contours Smooths the contour lines, removing the sharp angles and giving the lines a spline connection.

Colormap Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Overlay grid Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Pre-process data Causes automatic statistical processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is deselected, the input spreadsheet data is graphed. Note that if a new graph is created based on the output spreadsheet and pre-processing is deselected, the result is a graph of the processed data without a wait for processing.

Labeling

Major levels Displays a data label on each major contour line on the graph. The data label represents the "Z" value for the graph.

Minor levels Displays a data label on each minor contour line on the graph. The data label represents the "Z" value for the graph.

Rotate labels Rotates the major or minor data labels parallel with the tangent to the contour. Only applicable for labels that are displayed using the Major levels or Minor levels checkboxes. This option will not rotate data labels that were added using the Data Labels item on the Format menu.

Legend Entries Includes a sample of the major and minor contour line samples in the legend.

Automatic Formatting

Index line colors — Assigns a different line color to major and minor contour levels. The colors used are predefined. (To change an individual line color choose **Color** from the Format menu.)

Index line styles — Assigns a different pre-set line style to each contour level. The line styles used are predefined. (To change an individual line style choose **Line Style** from the Format menu.)

Index line weights — Assigns a different pre-set line weight to major/minor contour increments.

Sublevels — Sets the number of minor contour levels displayed between each major level.

Setting Styles for Shadow-Contour Plots

The Shadow-Contour Plot Style dialog contains display options for the selected graph.

Display Options

Smooth contours — Smooths the contour lines, removing the sharp angles and giving the lines a spline connection.

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Show surface — Displays the plotted surface in addition to the contours. (This command does not apply to the Contour from Curves graph.)

Pre-process data	Causes automatic contouring processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is deselected, the input spreadsheet data is graphed. Note that if a new graph is created based on the output spreadsheet and pre-processing is deselected, the result is a graph of the processed data without a wait for processing.

Labeling

Major levels	Displays a data label on each major contour line on the graph. The data label represents the "Z" value for the graph.
Minor levels	Displays a data label on each minor contour line on the graph. The data label represents the "Z" value for the graph.
Use 2-D labels	Causes axis labels to be displayed as for a 2-D graph.
Rotate labels	Rotates the major or minor data labels parallel with the tangent to the contour. Only applicable for labels that are displayed using the Major levels or Minor levels checkboxes. This option will not rotate data labels that were added using the Data Labels item on the Format menu.
Legend Entries	Includes a sample of the major and minor contour line samples in the legend.

Automatic Formatting

Index line colors	Assigns a different line color to major and minor contour levels. The colors used are predefined. To change an individual line color, choose **Color** from the Format menu.
Index line styles	Assigns a different pre-set line style to major and minor contour levels. The line styles used are predefined. To change an individual line style, choose **Line Style** from the Format menu.
Index line weights	Assigns a different pre-set line weight to major and minor contour levels.
Sublevels	Sets the number of minor contour levels to be displayed between each major level.

Contour location

Top	Places the contour at the top of the plot in the X Y plane.
Standard	Maps the contour directly onto the plotted or hidden surface.
Bottom	Places the contour at the bottom of the plot in the X Y plane.

Automatic Processing for Contour Plots and Shadow-Contour Plots

Automatic processing for Contour Plots requires an XYZ matrix (a spreadsheet that contains X values in column A, Y values across row 1, and Z values in the rest of the spreadsheet). Contouring is a convenient way to analyze surfaces and 3-D Histograms. The process takes slices of a surface at constant Z values and generates a sequence of curves that can be thought of as the curves on a topographic map. These curves are held in separate tables in the output spreadsheet, one table for each contour level.

Each curve is defined by three columns of data of the form XYZ, so curves may be plotted in either two dimensions on a standard XY plot or as three-dimensional curves.

If your data is XYZ triplets, you can use a Surface Plot from Triplets to generate a matrix spreadsheet that can be used to produce a Contour Plot.

Processing for Shadow-Contour Plots is identical to that of 2-D and 3-D Contour Plots. The only difference is that both the input data set (the surface) and the output data set (the series of contours) are displayed on the graph.

Default Ranges for Automatic Processing Contour Plots

If you choose the automatic processing version of the Contour Plot, the Range Highlighter is not available to the input spreadsheet. The Helpful Hints dialog box shows you the default ranges for data. Harvard ChartXL computes the contours using the default ranges.

A sample input spreadsheet, set up to match the default ranges for the Contour Plot is displayed below.

T1	A	B	C	D	E
1	0	-42	-36.4687	-30.9333	-25.4
2	4	-2.71329	-1.03757	1.99388	6.52344
3	6.53333	-3.4448	-2.40257	-0.609091	5.90586
4	9.06667	-3.78734	-3.05481	-2.83713	1.12362
5	11.6	-4.09721	-3.05952	-3.00171	-1.89735

Anything in the A column, starting in cell A2 is defined as X. Anything in the first row, starting in cell B1 is defined as Y. Anything in the rest of the spreadsheet, starting in cell B2 and excluding the A column and the first row, is defined as Z.

Edit Processing for Contour and Shadow-Contour Plots

Once the processing is completed and the graph is drawn, you can change the ranges being calculated by clicking on the plotted data to select it and choosing **Edit Processing** from the Graph menu.

Data Ranges

X — Accepts entry of the spreadsheet range that contains your X values.

Y — Accepts entry of the spreadsheet range that contains your Y values.

Z — Accepts entry of the spreadsheet range that contains your Z values.

Z Levels

Auto-level — If checked, automatically processes the input data to determine minimum and maximum Z-values, as well as contour level increments.

Minimum — If auto-leveling is not selected, accepts entry of a minimum Z-value for contouring.

Maximum — If auto-leveling is not selected, accepts entry of a maximum Z value for contouring.

Increment — If auto-leveling is not selected, accepts entry of the increment at which contour levels are to be calculated between the minimum and maximum Z values.

Other Options

Graph Output — Graphs the Contour data from the output spreadsheet onto the selected graph. If deselected, Contour data is created but not graphed and the output spreadsheet is displayed.

Range Highlighter for No-Processing Contour Plots and Shadow-Contour Plots

The Range Highlighter for Contour Plots and Shadow-Contour Plots allows you to view and/or specify spreadsheet ranges for the chart. This range highlighter is available to the no processing version of the Contour Plot graph or to the output spreadsheet of the automatic processing version of Contour Plots, and to both the input and output spreadsheets of Shadow-Contour Plots.

Note: The Range Highlighter for Shadow-Contour Plots also includes a range for Legend labels.

Default Ranges for Contour and Shadow-Contour Plots

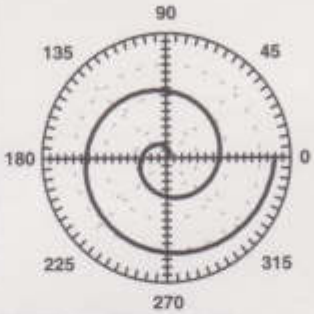
A Contour Plot is designed to plot contoured data from multiple tables, with a different contour level in each table. Each of the ranges below uses all the tables that are in the spreadsheet.

Graph Range	Default Location
X	All cells in the A column, beginning in cell A2.
Y	All cells in the B column, beginning in cell B2.
Z	All cells in the C column, beginning in cell C2.
Datapoint Labels	All cells in the C column, beginning in cell C2.
Color-Coding	All cells in the C column, beginning in cell C2.

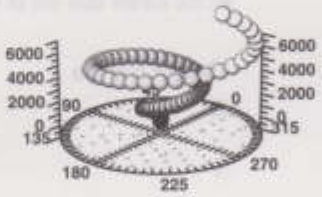
Polar Plots, Smith Charts, Trajectory Plots, and XY Plots

Two-and three-dimensional curves and lists of values can be plotted on several technical graphs, including Polar Plots, Smith Charts, Trajectory Plots, and XY Plots.

The **Polar Plot** is commonly used when data is represented in phase-magnitude form.



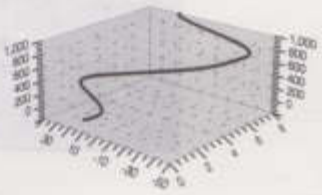
The **Polar Plot (3-D)** is similar to a 2-D Polar Plot, but with the addition of a third variable representing the Z value for each pair of radius and theta values.



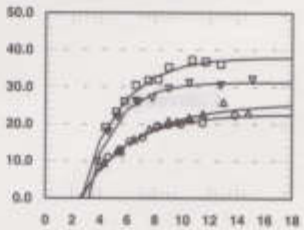
The **Smith Chart** is a specialized graph that plots a series of complex impedence values, specified in terms of real (resistance) and imaginary (reactance) components, on a circular diagram. The radius corresponds to the magnitude and the angle corresponds to the phase of the reflection coefficient.

The **3-D Smith Chart** adds a third variable to a 2-D Smith Chart.

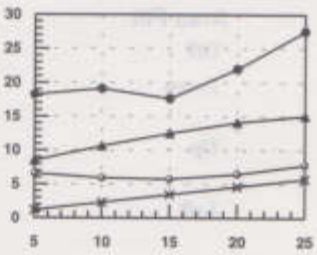
The **3-D Trajectory Plot** displays single or multiple curves in 3-D space using X, Y and Z data values.



The **Paired X Y Plot** is used to display curves of X Y data pairs, where each curve has unique X and Y values.

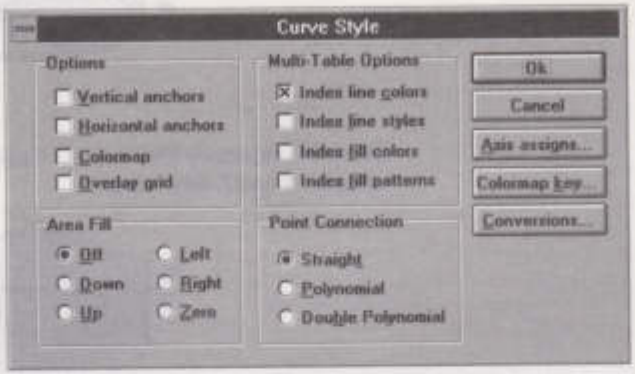


The **X Y Plot** displays X Y data pairs as a curve or curves, where the X values are the same for each Y.



Setting Styles for 2-D Polar Plots, Smith Charts, and X Y Plots

The Curve Style dialog contains display options for the selected graph.



Options

Vertical anchors — Draws a line from each graph data point to the lower graph border. Serves to further highlight the X data.

Horizontal anchors — Draws a line from each graph data point to the left graph border. Serves to further highlight the Y values of your data.

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Overlay grid — Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Area Fill

Off — De-selects area fill.

Down — Applies color /pattern fill from the curve downward.

Up — Applies color /pattern fill from the curve upward.

Left — Applies color /pattern fill from the curve to the left.

Right — Applies color /pattern fill from the curve to the right.

Zero — Applies color /pattern fill from the curve to zero.

Multi-Table Options

Index line colors

Assigns a different line color to each curve in a plotted data series containing multiple curves. The colors used are predefined. To change an individual line color, choose **Color** from the Format menu.

Index line styles

Assigns a different line style to each curve in a plotted data series containing multiple curves. The line styles used are predefined. To change an individual line style, choose **Line Style** from the Format menu.

Index fill colors

Assigns a different fill color to each curve in a plotted data series containing multiple curves. The colors used are predefined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns

Assigns a different fill pattern to each curve in a plotted data series containing multiple curves. The fill patterns used are predefined. To change an individual fill pattern, choose **Fill** from the Format menu.

Point Connection

Straight

Connects the points on the graph with straight lines, making sharp angles at the bends in the ribbon.

Polynomial

Connects the points on the graph with a polynomial interpolation on X.

Double Polynomial

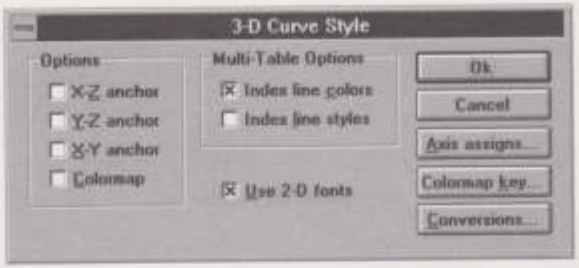
Connects the points on the graph with a polynomial interpolation on X and Y.

Conversions

See *Conversions* in **Statistical Graphs.**

Setting Styles for 3-D Polar Plots, Smith Charts, and Trajectory Plots

The 3-D Curve Style dialog contains display options for the selected graph.



Options

X-Z anchor — Draws a line from each graph data point to the X-Z plane.

Y-Z anchor — Draws a line from each graph data point to the Y-Z plane.

X Y anchor — Draws a line from each graph data point to the X-Y plane.

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Multi-Table Options

Index line colors — Assigns a different line color to each curve in a plotted data series containing multiple curves. The colors used are predefined. To change an individual line color, choose **Color** from the Format menu.

Index line styles — Assigns a different line style to each curve in a plotted data series containing multiple curves. The line styles used are predefined. To change an individual line style, choose **Line Style** from the Format menu.

Other Options

Use 2-D fonts — Forces axis labels to be horizontal non-rotated text.

Conversions — See *Conversions* in **Statistical Graphs**.

Range Highlighter for 2-D Polar Plots, Smith Charts, and X Y Plots

The Range Highlighter for Polar Plots, Smith Charts, and X Y Plots allows you to view and/or specify five spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1	A	B	C	D
1	Angle	Radius		
2	20	0		
3	30	5		
4	40	10		
5	50	15		

Default Ranges for 2-D Polar Plots, Smith Charts, and X Y Plots

Graph Range	Default Location
X	All cells in the A column, beginning in cell A2.
Y	All cells in the B column, beginning in cell B2.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Color-Coding	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Legend Labels	All cells in the first row, beginning in cell B1.

Range Highlighter for Paired X Y Plots

The Range Highlighter for Paired X Y Plots allows you to view and/or specify seven spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1	A	B	C	D
1	X1	Y1	X2	Y2
2	13.2	3.223	7.9	2.774
3	14.7	5.251	8.3	2.872
4	15.2	5.332	8.7	3.124
5	15.5	5.767	9.3	3.254

Default Ranges for Paired X Y Plots

Graph Range	Default Location
Curve Range	All cells in the spreadsheet that are used on the graph.
First Curve	All cells in the A and B columns.
X	All cells in the A column, beginning in cell A2.
Y	All cells in the B column, beginning in cell B2.
Datapoint Labels	All cells in the B column, beginning in cell B2.
Color-Coding	All cells in the B column, beginning in cell B2.
Legend Labels	All cells in the first row, beginning in cell B1.

Note: The Paired X Y Plot works based on a pattern in the spreadsheet. You define the ranges for the first curve, and that pattern is repeated throughout the range that was designated as Curve Range. For example: Define the A column as X and the B column as Y. Define columns A through D as Curve Range. Your graph will have two curves, one curve representing columns A and B, the second curve representing columns C and D.

Range Highlighter for 3-D Polar Plots, Smith Charts, and Trajectory Plots

The Range Highlighter for 3-D Polar Plots, 3-D Smith Charts, and Trajectory Plots allows you to view and/or specify six spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

T1	A	B	C	D
1	Angle	Radius	Z	
2	20	0	0	
3	30	5	100	
4	40	10	200	
5	50	15	300	

Default Ranges for 3-D Polar Plots, Smith Charts, and Trajectory Plots

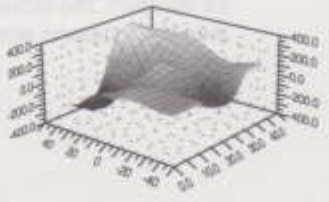
Graph Range	Default Location
X	All cells in the A column, beginning in cell A2.
Y	All cells in the B column, beginning in cell B2.
Z	All cells in the spreadsheet, beginning in cell C2 and excluding the A column and the first row.
Datapoint Labels	All cells in the spreadsheet, beginning in cell C2 and excluding the A column and the first row.

Color-Coding	All cells in the spreadsheet, beginning in cell C2 and excluding the A column and the first row.
Legend Labels	All cells in the first row, beginning in cell B1.

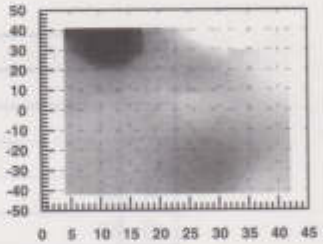
Surface Plots and Spectral Plots

The **3-D Surface Plot from Matrix** graphs a matrix of X, Y, and Z values as a three-dimensional grid or mesh.

The **3-D Surface Plot from Triplets** is an automatic processing graph that processes triplet data and produces an interpolated surface.



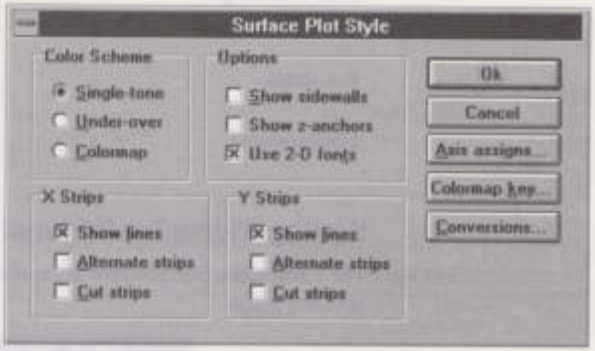
The **Spectral Plot** is a two-dimensional display of a surface matrix of data. It is similar to a Contour Plot; however, the Z values are represented by a colormap fill rather than contour lines.



The **Parametric Surface Plot** is similar to the Surface Plots but requires three matrices, or grids, of data.

Setting Styles for Surface Plots

The Surface Plot Style dialog contains display options for the selected graph.



Color Scheme

Single-tone — Assigns only one color to the surface.

Under-over — Assigns one color to the top and another color to the underside of the surface.

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Options

Show sidewalls — Draws sides around a surface making the surface appear solid.

Show z-anchors — Drops an anchor line from each Z-value to the X Y plane.

Use 2-D fonts — Forces axis labels to be horizontal non-rotated text.

X Strips

Show lines — Displays lines across the surface in the X direction.

Alternate strips — Displays only every other X strip value, thereby highlighting trends in Y values.

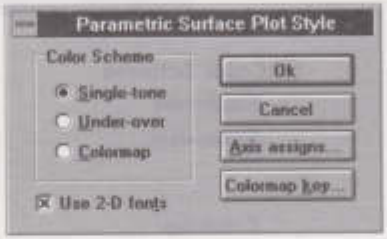
Cut strips — Disconnects X strip values, thereby highlighting trends in Y strip values.

Y Strips

Show lines	Displays lines across the surface in the Y direction.
Alternate strips	Displays only every other Y strip value, thereby highlighting trends in X values
Cut strips	Disconnects Y strip values, thereby highlighting trends in X strip values.
Conversions	See *Conversions* in **Statistical Graphs**.

Setting Styles for Parametric Surface Plots

The Parametric Surface Plot Style dialog contains display options for the selected graph.



Color Scheme

Single-tone	Assigns only one color to the surface.
Under-over	Assigns one color to the top and another color to the underside of the surface.
Colormap	Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.
Use 2-D fonts	Forces axis labels to be horizontal non-rotated text.

Automatic Processing for Surface Plots from Triplets

Harvard ChartXL uses an inverse-distance weighting algorithm to generate a rectangular M by N grid of points over a specified range of the two independent variables, X and Y. At each point in the grid, an X, Y, and Z value is computed. A sequence of M uniformly spaced values of X is computed over the specified range of minimum and maximum X values. A similar sequence of N uniformly spaced values of Y is computed over the specified range Y minimum to Y maximum. Then, for each value of X and Y, the dependent variable is computed by dividing the weighted sum of each Z_i in the list of triplets by a normalizing factor equal to the sum of the weighting factors.

The weighting factor for each Z_i is the reciprocal of the distance the point (x,y) is from the point (x_i, y_i) raised to some power, P. Thus, the closer a point being calculated is to a particular triplet, the more heavily it will be considered in the weighted sum. Conversely, the further a point being calculated is from a particular triplet, the less it will be considered in the sum. If, in computing the weighted sum, a triplet is found with the same X and Y values as the point being computed, a direct hit is declared and Z is assigned the value of Z_i.

A normalize option exists which normalizes the distances between the average X increment and the average Y increment. If X and Y are not spatially related, but are more like independent parameters that are allowed to vary freely, this feature is useful in making sure both variables have the same amount of influence in determining a Z grid value. Otherwise, an independent variable that ranges from 0 to 1 in increments of .1 will have much more influence than another that ranges from 0 to 10 in increments of 1.

By specifying the power P used in the inverse weighting, you can influence the smoothness of the surface that is generated. Increasing P will make more distant points less significant on the resulting value being computed, thus making the surface appear more jagged. Decreasing the value of P will make the surface smoother by decreasing the importance of the closest points. A value of P equal to 1 or 2 is recommended at the beginning. A value of 0 results in a flat surface with a uniform Z value equal to the average of the Z values of the triplets. Negative values of P will result in weighting distant points more heavily than those that are close.

Default Ranges for Automatic Processing Surface Plots from Triplets

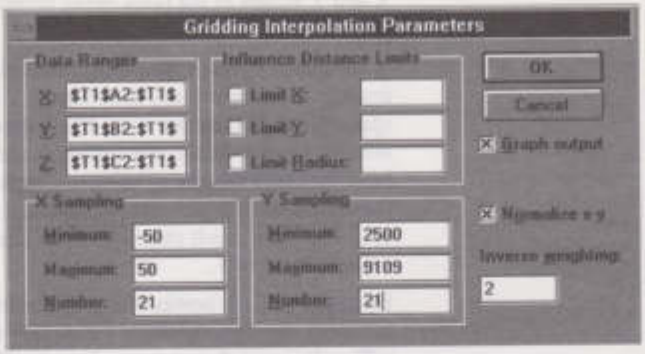
If you choose Surface Plot from Triplets, the Range Highlighter is not available to the input spreadsheet, but the Helpful Hints dialog box shows you the default ranges for data. Harvard ChartXL computes a matrix using the default ranges for this graph. A sample input spreadsheet, set up to match the default ranges for the Surface Plot, is displayed below.

T1	A	B	C	D
1	X	Y	Z	
2	0	0	10	
3	0.0808081	7.75552	20	
4	0.161616	6.62305	30	
5	0.242424	5.83525	40	

Column A, starting in cell A2, is defined as X. Column B, starting in cell B2, is defined as Y. Column C, starting in cell C2, is defined as Z.

Edit Processing for Surface Plots from Triplets

Once the processing is completed and the graph is drawn, you can change the ranges being calculated by clicking on the plotted data to select it and choosing **Edit Processing** from the Graph menu, to adjust the ranges being used for the matrix.



Data Ranges

X — Accepts entry of the spreadsheet range that contains the X data to be interpolated.

Y — Accepts entry of the spreadsheet range that contains the Y data to be interpolated.

Z — Accepts entry of the spreadsheet range that contains the Z data to be interpolated.

Influence Distance Limits

Limit X — Specifies the maximum distance at which an input X data point can lie and still be used in the calculation of the output point. Points beyond this limit are ignored in the calculation of the surface.

Limit Y — Specifies the maximum distance at which an input Y data point can lie and still be used in the calculation of the output point. Points beyond this limit are ignored in the calculation of the surface.

Limit Radius — Specifies the maximum distance at which an input radius point can lie and still be used in the calculation of the output point. Points beyond this limit are ignored in the calculation of the surface.

X Sampling

Minimum	Accepts entry of the minimum X value.
Maximum	Accepts entry of the maximum X value.
Number	Accepts entry of the number of sampling intervals in the X data range.

Y Sampling

Minimum	Accepts entry of the minimum Y value.
Maximum	Accepts entry of the maximum Y value.
Number	Accepts entry of the number of sampling intervals in the Y data range.

Other Options

Graph output	Graphs data from the output spreadsheet onto the selected graph. If deselected, the spreadsheet will be created but the data will not be displayed on the graph.
Normalize x y	Normalizes the distance between the average x increment and the average y increment.
Inverse weighting	Accepts entry of the power P, used in the inverse weighting to influence the smoothness of the surface that is generated.

Range Highlighter for Surface Plots and Spectral Plots

The Range Highlighter for Surface Plots and Spectral Plots allows you to view and/or specify six spreadsheet ranges for the chart. This range highlighter is available to the output spreadsheet of the Surface Plot from Triplets, to Spectral Plots, and to Surface Plots from Matrix.

Default Ranges for Surface Plots and Spectral Plots

Graph Range	Default Location
X	All cells in the A column, beginning in cell A2.
Y	All cells in the first row, beginning in cell B1.
Z	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Color-Coding	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Legend Labels	Cell A1.

Note: The input spreadsheet for a Surface Plot or Spectral Plot must be in the form of a matrix, or grid, of data. If your data is in triplet format (three columns), you can first plot your data to a Surface Plot from Triplets, which gives you a new spreadsheet in matrix format. You can then use this new spreadsheet as the input for the Surface Plot or Spectral Plot.

Range Highlighter for Parametric Surface Plots

The Range Highlighter for Parametric Surface Plots allows you to view and/or specify six spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured. Note that multiple tables are used for the graph.

T1 | T2 | T3 | T4

T1	A	B	C	D	E
1	0	0	0	0	0
2	15	14.228	11.9916	8.52097	4.17326
3	30	28.4561	23.9833	17.0419	8.34652
4	45	42.6841	35.9749	25.5629	12.5198
5	60	56.9122	47.9666	34.0839	16.693
6	75	71.1402	59.9582	42.6049	20.8663
7	90	85.3683	71.9498	51.1258	25.0396

T1 | T2 | T3 | T4

T2	A	B	C	D	E
1	0	0	0	0	0
2	0	4.75002	9.01113	12.3448	14.4078
3	0	9.50004	18.0223	24.6895	28.8155
4	0	14.2501	27.0334	37.0343	43.2233
5	0	19.0001	36.0445	49.379	57.6311
6	0	23.7501	45.0557	61.7238	72.0389
7	0	28.5001	54.0668	74.0685	86.4466

T1 | T2 | T3 | T4

T3	A	B	C	D	E
1	0	0	0	0	0
2	0.052336	0.0516682	0.0496426	0.0463412	0.0418396
3	0.104528	0.103175	0.0991491	0.0925554	0.0835645
4	0.156434	0.154409	0.148384	0.138516	0.12506
5	0.207912	0.205219	0.197212	0.184097	0.166213
6	0.258819	0.255467	0.245499	0.229173	0.206911
7	0.309017	0.305015	0.293114	0.273621	0.247041

T1 | T2 | T3 | T4

T4	A	B	C	D	E
1	0	0	0	0	0
2	0.258819	0.206911	0.072008	-0.0917785	-0.218751
3	0.5	0.399721	0.139109	-0.177302	-0.422595
4	0.707107	0.565291	0.196729	-0.250744	-0.59764
5	0.866025	0.692338	0.240943	-0.307097	-0.731956
6	0.965926	0.772202	0.268737	-0.342522	-0.816391
7	1	0.799443	0.278217	-0.354605	-0.84519

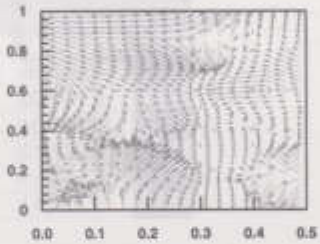
The input spreadsheet for a Parametric Surface Plot must be in the form of a matrix, or grids, of data. X,Y, and Z must be complete grids of data, and each grid should be the same size.

Default Ranges for Parametric Surface Plots

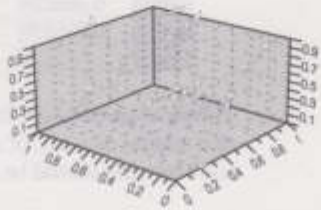
Graph Range	Default Location
X	All cells in table 1, beginning in cell A1.
Y	All cells in table 2, beginning in cell A1.
Z	All cells in table 3, beginning in cell A1.
Color-Coding	All cells in table 4, beginning in cell A1.
Datapoint Labels	All cells in table 3, beginning in cell A1.
Legend Labels	Cell A1 in table 5.

Vector Plots

The **Vector Plot** displays the location, direction, and magnitude of X Y data pairs.



The **3-D Vector Plot** is similar to the 2-D Vector Plot, but uses 6 columns of data instead of 4. Three columns define the X,Y,Z origin and three columns define the X,Y,Z velocity or direction of each vector arrow.



Setting Styles for 2-Dimensional Vector Plots

The Vector Plot Style dialog contains display options for the selected graph.

Vector Size

Arrow length — Accepts entry of the arrow length in points (1/72").

Arrowhead ratio — Accepts entry of a number that sizes the arrowhead as a percentage of the length of the arrow; for example, if the arrow length is 36 points and the ratio is 100, the arrowhead is 36 points wide.

Shaft width — Accepts entry of the arrow line width in points (1/72").

Vector Scaling

Same size — Scales the vectors equally.

Linear scale — Applies linear scaling to the vectors.

Log scale — Applies log scaling to the vectors.

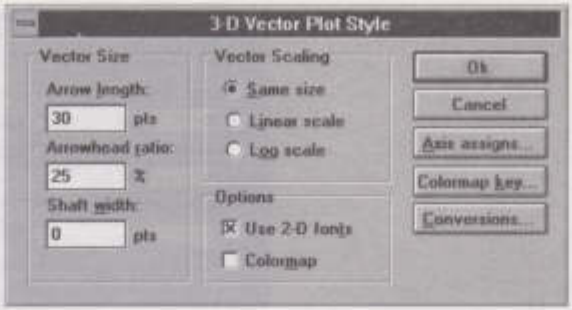
Options

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Overlay grid — Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Setting Styles for 3-D Vector Plots

The 3-D Vector Plot Style dialog contains display options for the selected graph.



Vector Size

Arrow length — Accepts entry of the arrow length in points (1/72").

Arrowhead ratio — Accepts entry of a number that sizes the arrowhead as a percentage of the length of the arrow; for example, if the arrow length is 36 points and the ratio is 100, the arrowhead is 36 points wide.

Shaft width — Accepts entry of the arrow line width in points (1/72").

Vector Scaling

Same size — Scales the vectors equally.

Linear scale — Applies linear scaling to the vectors.

Log scale — Applies log scaling to the vectors.

Options

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Overlay grid — Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Conversions — See *Conversions* in **Statistical Graphs**.

Range Highlighter for 2-D Vector Plots

The Range Highlighter for Vector Plots allows you to view and/or specify seven spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.

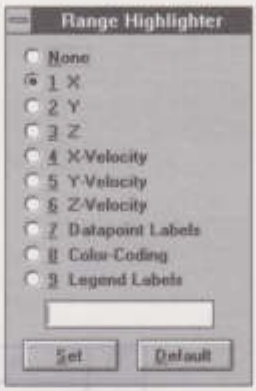
T1	A	B	C	D
1	X	Y	X Velocity	Y Velocity
2	0	0.025641	0.79082	0.398996
3	0	0.0512821	0.83622	-0.0570948
4	0	0.0769231	0.826854	-0.254218
5	0	0.102564	0.771234	-0.263343

Default Ranges for 2-D Vector Plots

Graph Range	Default Location
X	All cells in the A column, beginning in cell A2.
Y	All cells in the B column, beginning in cell B2.
X-Velocity	All cells in the C column, beginning in cell C2.
Y-Velocity	All cells in the D column, beginning in cell D2.
Datapoint Labels	All cells in the A column, beginning in cell A2.
Color-Coding	All cells in the B column, beginning in cell B2.
Legend Labels	Cell B1.

Range Highlighter for 3-D Vector Plots

The Range Highlighter for 3-D Vector Plots allows you to view and/or specify nine spreadsheet ranges for the chart. The default ranges for the graphs displayed are shown in the sample spreadsheet pictured.



T1	A	B	C	D	E	F
1	X	Y	Z	X Velocity	Y Velocity	Z Velocity
2	0.193298	0.808716	0.611481	0.382426	0.268205	0.267272
3	0.584981	0.479858	0.840116	0.0237427	0.379854	0.0826208
4	0.350281	0.695935	0.677185	0.0562134	0.00870908	0.918782
5	0.822815	0.746582	0.275879	0.272888	0.587891	0.691162

Default Ranges for 3-D Vector Plots

Graph Range	Default Location
X	All cells in the A column, beginning in cell A2.
Y	All cells in the B column, beginning in cell B2.
Z	All cells in the C column, beginning in cell C2.
X-Velocity	All cells in the D column, beginning in cell D2.
Y-Velocity	All cells in the E column, beginning in cell E2.
Z-Velocity	All cells in the F column, beginning in cell F2.
Datapoint Labels	All cells in the C column, beginning in cell C2.
Color-Coding	All cells in the C column, beginning in cell C2.
Legend Labels	Cell C1.

The Formula Solver

The Harvard ChartXL Formula Solver allows you to graph a formula. You can create an equation, set limits for the data to be used, and click a button to graph an equation representing a curve or surface.

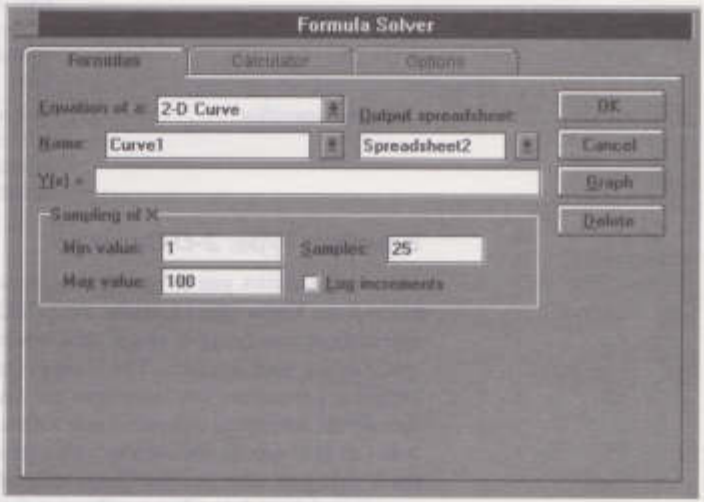
The Formula Solver dialog box contains an equation generator and a calculator.

Using the Formula Solver Equation Generator

The Formula Solver allows you to enter your own equations for 2-D and 3-D curves and surfaces, placing the results directly in a spreadsheet, or to a spreadsheet and a graph.

To open the Formula Solver:

Choose **Formula Solver** from the Tools menu or click the button in the Analysis tool bar. The Formula Solver dialog opens.



This dialog changes to reflect the type of equation that you want to define. The results of the formula are stored in a spreadsheet, and you can graph the results with a single mouse click.

Name	Displays the name of the selected equation. When you define an equation it is given a default name. You can use the default name, or you can type in one of your own. Since each equation can be given a unique name, you can store multiple equations in a file, for future use. Click on the down arrow next to the name box to choose from a list of existing equations.
Equation of a	Allows you to choose a general equation type. The available types, and a detailed explanation of what is required in each appear in subsequent sections.
Output Spreadsheet	Displays the name of the spreadsheet that the calculated results are stored to. Click on the down arrow next to the Output Spreadsheet box to display a list of all spreadsheets that exist in the current file. You can choose to overwrite an existing spreadsheet, or you can create a new one. Unless you type in a new name or choose an existing spreadsheet, a new spreadsheet is created and named for you.
Equation specifics	This section changes for each type of equation chosen. The different equation types are displayed in detail in subsequent sections.

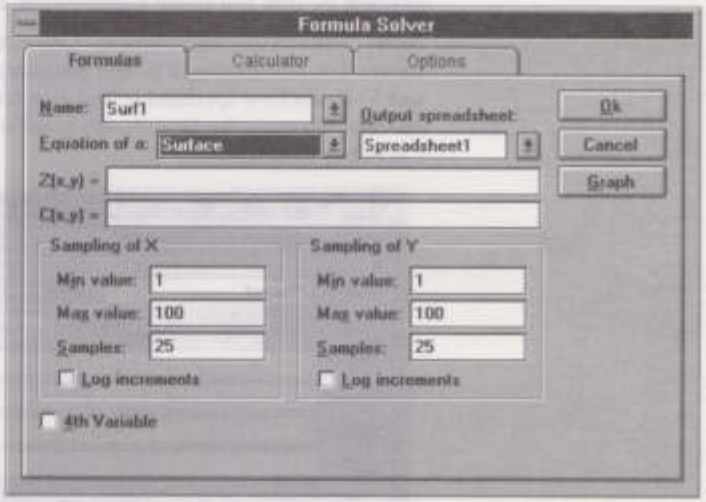
Equation Type: 2-D Curve

This option allows you to specify an equation for a 2-dimensional curve in the form **Y(x)=** (for example: Y(x)=X^2). This equation creates a spreadsheet containing X and Y data, where Y is a function of X as specified by your equation. The X data is generated based on the sampling parameters that have been set. Use the Sampling of X area to specify the minimum and maximum values that you want used for X. You can also specify the number of points to output, or choose to have the X data generated in logarithmic intervals. Click OK to generate the new spreadsheet data when you have defined the formula. If you want to graph the data and create a spreadsheet, click Graph.

To see the dialog box options for this equation type, see *Using the Formula Solver Equation Generator.*

Equation Type: Surface

This option allows you to define an equation for a surface in the form **Z(x,y)=** (for example: Z(x,y)=(x^2)*sin(y)). The calculated results create a spreadsheet in the form of X,Y, and Z, where Z is a function of X and Y. The Z data forms a matrix, with a Z value for each X,Y pair. The X and Y data is generated based on the minimum and maximum values that are set in the Sampling of X and Sampling of Y areas. You can also specify the number of points to be used for each sampling, or choose to have the X and Y data generated in logarithmic intervals. Click OK to generate the new spreadsheet data when you have defined the formula. If you want to graph the data and create a spreadsheet, click Graph.

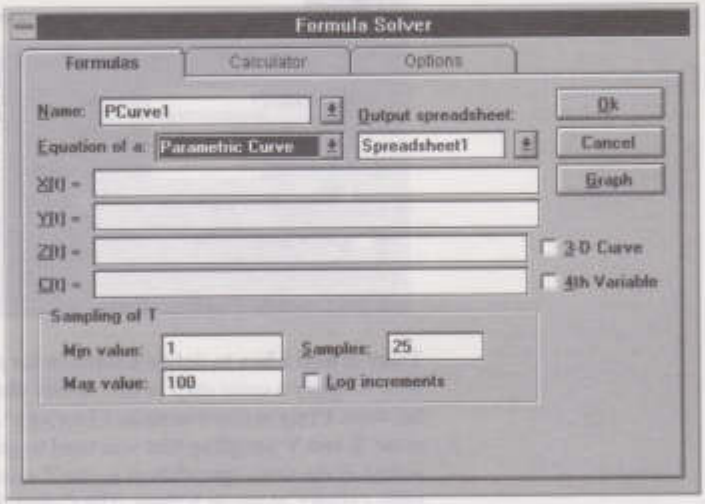


There is also a box to define a formula for a 4th variable (C), which is used to apply a color map to the surface plot. This equation is specified in the form **C(x,y)=** (for example: C(x,y)=(x^2)*y). C is generated using the same X and Y sampling that was used to generate Z. The C values are stored in the same spreadsheet as the Z values, but are placed in a new table called Colormap Values. The C data forms a complete matrix, where there is a C value for each X,Y pair. If you have chosen to graph the data, the colormap is automatically applied to your graph. You can turn off the colormap on the graph, but retain the formula, by deselecting the 4th Variable checkbox.

Equation Type: Parametric Curve

This option allows you to define parametric equations for a curve. X, Y, and Z must all be defined as separate equations in the form **X** or **Y** or **Z(t)**=(for example: X(t)=cos(t^2), Y(t)=sin(t) and Z(t)=t*3). The calculated results create a spreadsheet in the form of X, Y, and Z, where X, Y, and Z are all functions of T as specified. Each equation produces a separate column in the new spreadsheet. The T data is generated based on the minimum and maximum values that are set in the Sampling of T area. You can also specify the number of points to output for T, or choose to have the T data generated in logarithmic intervals. Click OK to generate the new spreadsheet data when you have defined the formula. If you want to graph the data and create a spreadsheet, click Graph.

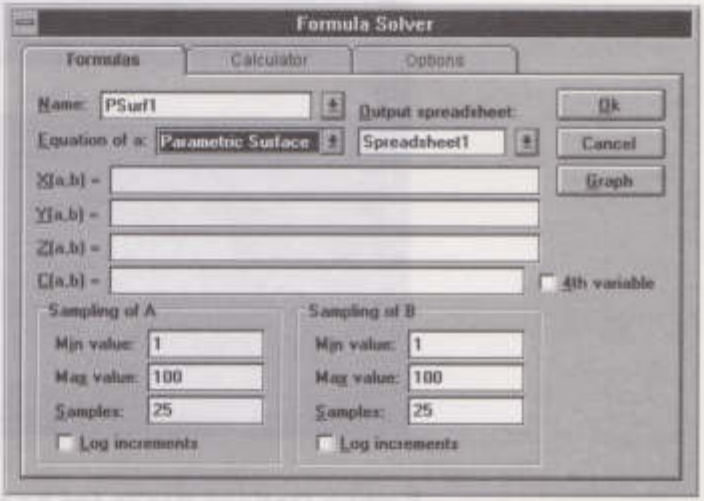
Note: You can use the Parametric Curve option to generate 2-D or 3-D curves. For a 2-D curve, it is only necessary to specify equations for X and Y. If you have specified an equation for Z, the 3-D Curve box is checked. To retain the formula, but graph only X and Y, click on the 3-D Curve box to turn it off.



There is also a box to define a formula for a 4th variable (C), which is used to apply a color map to the curve. This equation is specified in the form **C(t)**= (for example C(t)=(t*.25). C is generated using the same Y sampling that was used to generate X, Y, and Z. The C values are stored in the same spreadsheet as X, Y, and Z. If you have chosen to graph the data, the colormap is automatically applied to your graph. You can turn off the colormap on the graph, but retain the formula, by deselecting the 4th Variable checkbox.

Equation Type: Parametric Surface

This option allows you to define equations for a parametric surface. X, Y, and, Z must all be defined as separate equations in the form **X** or **Y** or **Z(a,b)**=(for example: X(a,b)=cos(a)+sin(b), Y(a,b)=sin(a+b) and Z(a,b)=(a+b)*b). The calculated results create a spreadsheet in the form of X, Y, and Z. X, Y, and Z each form a matrix with a value for each A,B pair and each matrix is stored in a different table in the spreadsheet. The A and B data is generated based on the minimum and maximum values that are set in the Sampling of A and Sampling of B areas. You can also specify the number of points to output for each sampling, or choose to have the A or B data generated in logarithmic intervals. Click OK to generate the new spreadsheet data when you have defined the formula. If you want to graph the data and create a spreadsheet, click Graph.



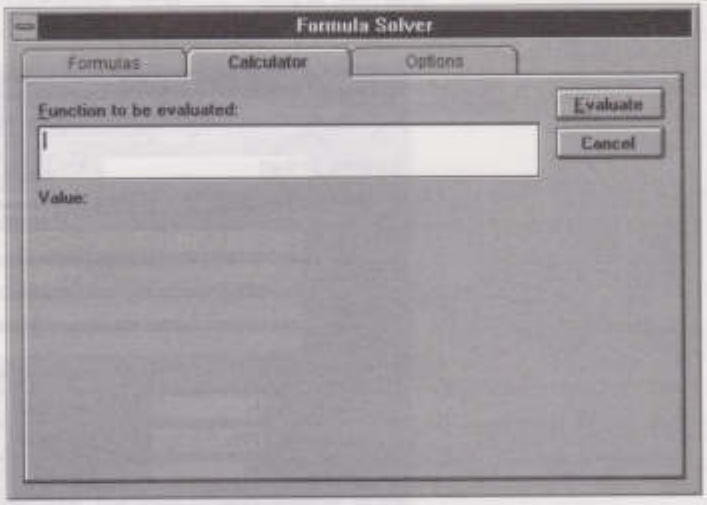
There is also a box to define a formula for a 4th variable (C), which is used to apply a color map to the surface plot. This equation is specified in the form **C(a,b)**= (for example C(a,b)=(a+5/b). C is generated using the same A and B sampling that was used to generate X, Y, and Z. The C values are stored in the same spreadsheet as X, Y, and Z but are in a separate table. If you have chosen to graph the data, the colormap is automatically applied to your graph. You can turn off the colormap on the graph, but retain the formula, by deselecting the 4th Variable checkbox.

Using the Formula Solver Calculator

Use the calculator to make a quick calculation or check the validity of a calculation in the spreadsheet. The calculator can evaluate equations using any of the arithmetic or trigonometric functions described in **Working with Formulas**. The results of any calculations performed with the calculator are displayed only in the calculator dialog.

To use the calculator:

Choose **Formula Solver** from the Tools menu or click on the Formula Solver button in the Analysis tool bar. The Formula Solver dialog opens. Click on the Calculator tab at the top. Type your equation in the area for the Function to be evaluated. Click Evaluate to display the result.



Setting Options (Units for Angles)

Click the Options tab and select Degrees or Radians before evaluating your formulas.

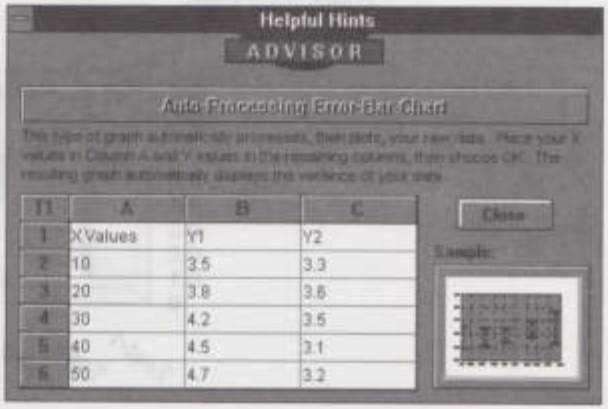
Statistical Graphs

Overview of Statistical Graphs

The Statistical Graphs category consists of graphs that are used for statistical applications, such as displaying error-bars and randomly sampled data. In **Statistical Graphs**, you will find a brief description of each statistical graph type, along with the Style dialog box, Range Highlighter, and a sample spreadsheet for each graph. Several of the graph types are similar in usage and share common Style dialog boxes and Range Highlighters. These related graphs are grouped together.

Box-Whisker Plots, Error Bar Charts, Histograms, and Pareto Charts are *automatic processing* graphs. When you select an automatic processing graph, the data in your input spreadsheet is processed and placed in a new output spreadsheet, which is used to plot the graph.

When you create a spreadsheet for an automatic processing graph, Harvard ChartXL displays the Advisor Helpful Hints dialog box to tell you how data will be processed by Harvard ChartXL.

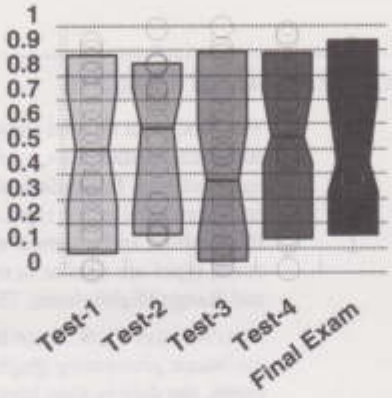


T1	A	B	C
1	X Values	Y1	Y2
2	10	3.5	3.3
3	20	3.8	3.6
4	30	4.2	3.5
5	40	4.5	3.1
6	50	4.7	3.2

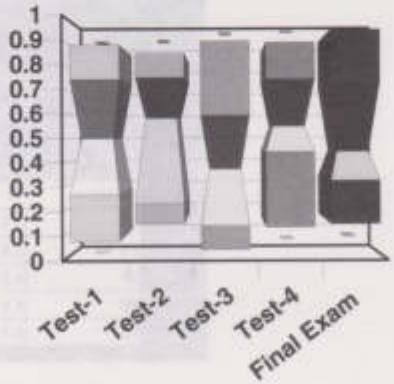
The automatic processing graphs also have a *no processing* option. You can choose the no processing option to graph data that has already been processed.

Box-Whisker Plots

The **Box-Whisker Plot** is an automatic processing graph. It is used to show the distribution and grouping of data samples. It computes and displays the median and distribution of several columns of data. The boxes separate the data into quartiles; the "whiskers" define the outlying 5% of the data values.



The **3-D Box-Whisker Plot** is identical to the 2-D version, but adds a 3-D look to the graph.



Select the 2-D or 3-D **Box Whisker Plot (no processing)** to plot pre-processed data.

Setting Styles for 2-D Box-Whisker Plots

The Box-Whisker Plot Style dialog box contains display options for the selected graph.

Display Options

Show whiskers — Displays a "whisker" drawn from each box end to the 5th and 95th percentiles. Samples beyond the whiskers represent the outlying 5%.

Show box — Draws a rectangle beginning at the tenth and ending at the ninetieth percentile. The middle quartiles are defined by the notch.

Show notch — Displays a "notch" in the box that takes the median out to the upper and lower quartiles (75th and 25th percentiles). If the median line is not shown, then showing the notch isolates the 10th to 25th percentiles and the 75th to 95th percentiles.

Show median — Displays a line within the box representing the median.

Show samples — Plots the actual samples for the distribution as dots along the central axis of each Box-Whisker.

Overlay grid — Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Color Options

Index line colors

Assigns a different line color to each Box-Whisker. The colors used are predefined. To change an individual line color, choose **Color** from the Format menu. Note that if you index line and fill colors simultaneously, the median line will become the same color as the Box-Whisker and will not be displayed. However, the notch will indicate the location of the median.

Index fill colors

Assigns a different fill color to each Box-Whisker. The colors used are predefined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns

Assigns a different fill pattern to each Box-Whisker. The fill patterns used are predefined. To change an individual fill pattern, choose **Fill** from the Format menu.

Other Options

Box Width

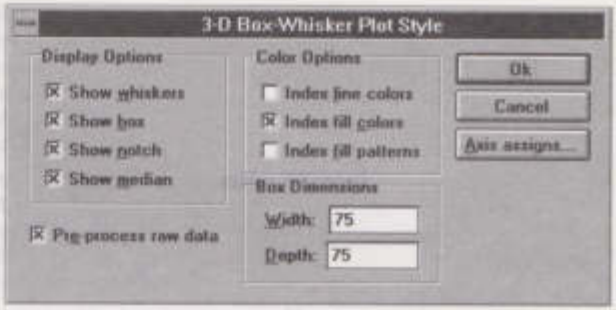
Accepts entry of a number that adjusts the width of boxes. One hundred equals maximum width. Zero equals minimum width.

Pre-process raw data

Causes automatic processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is de-selected, the input spreadsheet data is graphed directly. Note that if a new graph is created based on the output spreadsheet and pre-processing is de-selected, the result is a graph of the processed data without a wait for processing.

Setting Styles for 3-D Box-Whisker Plots

The 3-D Box-Whisker Plot Style dialog box contains display options for the selected graph.



Display Options

Show whiskers — Displays a "whisker" drawn from each box end to the 5th and 95th percentiles. Samples beyond the whiskers represent the outlying 5%.

Show box — Draws a rectangle beginning at the tenth and ending at the ninetieth percentile. The middle quartiles are defined by the notch.

Show notch — Displays a notch in the box that takes the median out to the upper and lower quartiles (75th and 25th percentiles). If the median line is not shown, then showing the notch isolates the 10th to 25th percentiles and the 75th to 95th percentiles.

Show median — Displays a line within the box representing the median.

Color Options

Index line colors

Assigns a different line color to each Box-Whisker. The colors used are predefined. To change an individual line color, choose **Color** from the Format menu. Note that if you index line and fill colors simultaneously, the median line will become the same color as the Box-Whisker and will not be displayed. However, the notch will indicate the location of the median.

Index fill colors

Assigns a different fill color to each Box-Whisker. The colors used are predefined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns

Assigns a different fill pattern to each Box-Whisker. The fill patterns used are predefined. To change an individual fill pattern, choose **Fill** from the Format menu.

Box Dimensions

Width

Accepts entry of a number that adjusts the width of the boxes. One hundred equals maximum width. Zero equals minimum width.

Depth

Accepts entry of a number that adjusts the depth of the boxes. One hundred equals maximum width. Zero equals minimum width.

Other Options

Pre-process raw data

Causes automatic statistical processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is deselected, the input spreadsheet data is graphed directly. Note that if a new graph is created based on the output spreadsheet and pre-processing is deselected, the result is a graph of the processed data without a wait for processing.

Automatic Processing for Box-Whisker Plots

Automatic processing for Box-Whisker plots produces an output spreadsheet containing the computed distribution of data in the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles, as well as the calculated mean and the input samples.

Default Ranges for Automatic Processing Box-Whisker Plots

If you choose the automatic processing version of the Box-Whisker Plot, the Range Highlighter is not available to the input spreadsheet, but the Helpful Hints dialog box shows you the default ranges for data. Harvard ChartXL then computes the statistics using these default ranges. A sample input spreadsheet, set up to match the default ranges for the Box Whisker Plot, is displayed below.

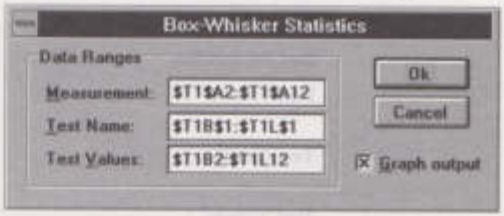
T1

T1	A	B	C	D
1	0	Test-1	Test-2	Test-3
2	Ralph	0.808716	0.611481	0.392426
3	Frank	0.479858	0.840118	0.0237427
4	Sherry	0.895935	0.677185	0.0562134
5	Charles	0.746582	0.275879	0.272888
6	David	0.858917	0.837585	0.726471
7	Karen	0.513519	0.743713	0.468445

Anything in the A column, starting in cell A2, will be used as measurement names in the output spreadsheet. Anything in the first row, starting in cell B1, will be used as test names in the output spreadsheet. Anything in the rest of the spreadsheet, starting in cell B2, will be used as test values in the output spreadsheet.

Edit Processing for Box-Whisker Plots

Once the processing is completed, and the graph is drawn, you can change the ranges being calculated by clicking on the plotted data to select it and choosing **Edit Processing** from the Graph menu.



Data Ranges

Measurement	Accepts entry of the spreadsheet range that contains measurement data, for example student names
Test Name	Accepts entry of the spreadsheet range that contains the test names
Test Values	Accepts entry of the spreadsheet range that contains the test values or results

Other Options

Graph output	Graphs the data from the output spreadsheet onto the selected graph. If deselected, Box-Whisker statistics are generated but not graphed and the output spreadsheet is displayed.

Range Highlighter for No Processing Box-Whisker Plots

The Range Highlighter for a no-processing Box-Whisker Plot allows you to view and/or specify six spreadsheet ranges for the chart. This range highlighter is also available to the output spreadsheet of the automatic processing graph.

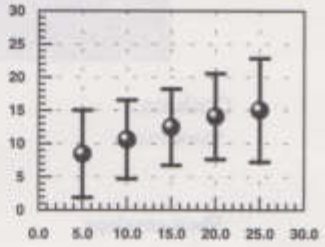
Default Ranges for No-Processing Box-Whisker Plots

Graph Range	Default Location
Box Percentiles	Cells A2 through A9.
Box Values	All cells in rows 2 through 9, beginning in cell B2.
Test Name	All cells in the first row, beginning in cell B1.
Test Values	All cells in the spreadsheet, beginning in cell B10 and excluding the first nine rows and the A column.

Measurement Name	All cells in the first column, beginning in cell A10.
Legend Labels	All cells in the first row, beginning in cell B1.

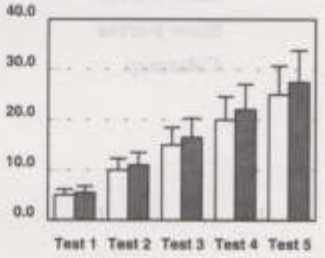
Error-Bar Plots and Column-Error Plots

The **Error-Bar Plot** is an automatic processing graph. Harvard ChartXL computes and displays the mean and min/max, standard deviation, or standard error of several columns of Y data for each value of X. Harvard ChartXL assumes that column A is X, row 1 contains labels, and remaining columns are Y values. The calculated error bar data is placed in a new spreadsheet.



Select **Error Bar Plot (no processing)** to plot pre-processed data with the range definitions you specify using the Range Highlighter. Provide a data file with the X, Y, and error values.

The **Column-Error Plot** displays the values of multiple categories of data as columns, with error bars to show their respective margins of error.



Setting Styles for Error-Bar Plots

The Error-Bar Style dialog box contains display options for the selected graph.

Options

Show curve — Displays a curve passing through the error bar mean values, highlighting the trend.

Show envelope — Displays two curves passing through the error bar minimum and maximum values respectively. Highlights the distribution trend.

Show stem — Displays/hides the error-bar lines spanning the minimum, mean and maximum values.

Show wings — Displays/hides wings showing the range of uncertainty.

Show x-error — Displays the uncertainty in the X data.

Show y-error — Displays the uncertainty in the Y data.

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key command button and through the Color Coding Range specified in the supporting spreadsheet.

Error Bar Wings

Display min/max — Specifies wings spanning the minimum, mean and maximum values of the variable.

Display std dev — Specifies wings displaying the spread of data about the mean when the standard deviation is being plotted.

Display std error	Specifies wings displaying the spread of data about the mean when the standard error is being plotted.
Width	Accepts entry of wing display width in points (1/72").

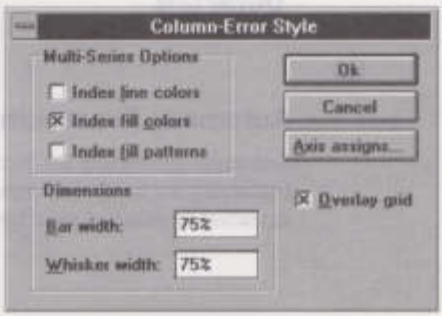
Other Options

Pre-process raw data	Causes automatic statistical processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is deselected, the input spreadsheet data is graphed. Note that if a new graph is created based on the output spreadsheet and pre-processing is deselected, the result is a graph of the processed data without a wait for processing.

Note: If you use the no processing version of the Error-Bar Plot, the Error-Bar Style dialog box will be slightly different. Since Harvard ChartXL has no way of knowing if you are plotting standard error or standard deviation from a processed spreadsheet, the option in the Error-Bar Wings section will read Display delta. Use this option to display the errors as standard deviation or standard error rather than min/max format.

Setting Styles for Column-Error Graphs

The Column-Error Style dialog box contains display options for the selected graph.



Multi-Series Options

Index line colors

Assigns a different line color to each column. The colors used are predefined. To change an individual line color, choose **Color** from the Format menu.

Index fill colors

Assigns a different fill color to each column. The colors used are predefined. To change an individual fill color, choose **Color** from the Format menu.

Index fill patterns

Assigns a different fill pattern to each column. The fill patterns used are predefined. To change an individual fill pattern, choose **Fill** from the Format menu.

Dimensions

Bar Width

Accepts entry of a number that adjusts the width dimension of the bars. One hundred equals maximum width. Zero equals minimum width.

Whisker Width

Accepts entry of a number that adjusts the width dimension of the whiskers on the columns, relative to the column width. One hundred equals maximum width. Zero equals minimum width.

Other Options

Overlay Grid

Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Automatic Processing for Error-Bar Plots

Automatic processing for Error-Bar plots produces an output spreadsheet containing the computed minimum, maximum, mean, and standard deviation or standard error for specified ranges of X and Y data.

Default Ranges for Automatic Processing Error-Bar Plots

If you choose the automatic processing version of the Error-Bar Plot, the Range Highlighter is not available to the input spreadsheet but the Helpful Hints dialog box shows you the default ranges for data. Harvard ChartXL then computes the statistics using the default ranges. A sample input spreadsheet, set up to match the default ranges for the Error-Bar Plot, is displayed below.

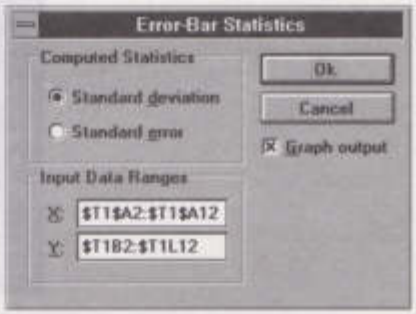
T1

T1	A	B	C	D
1	X Value	Y1	Y2	Y3
2	5	17.7	14.7	18.2
3	10	14.2	12.1	19.1
4	15	11	13.4	17.6
5	20	14.2	15.6	17.6
6	25	19.2	12.1	12.7
7	30	18.7	9.8	16.6

Anything in the A column, starting in cell A2, will be used to calculate calculate Y in the output spreadsheet.

Edit Processing for Error-Bar Plots

Once the processing is completed and the graph is drawn, you can change the ranges being calculated by clicking on the plotted data to select it and choosing **Edit Processing** from the Graph menu.



Computed Statistics

Standard deviation	Causes the output spreadsheet to contain standard deviation data, as well as min, mean, and max.
Standard error	Causes the output spreadsheet to contain standard error data, as well as min, mean, and max.

Input Data Ranges

X	Accepts entry of the spreadsheet range that contains the X values to be analyzed.
Y	Accepts entry of the spreadsheet range that contains the Y values to be analyzed.

Other Options

Graph output	Graphs the Error-Bar data from the output spreadsheet onto the selected graph. If deselected, Error-Bar data is created but not graphed and the output spreadsheet is displayed.

Range Highlighter for No Processing Error-Bar Plots

The Range Highlighter for no processing Error-Bar Plots allows you to view and/or specify eleven spreadsheet ranges for the chart. This range highlighter is also available to the output spreadsheet of the automatic processing version of the graph.

Note: You do not have to specify all of these ranges to create an Error-Bar Plot. You need to have at least X mean, Y mean, and min/max or deviation for X or Y.

Default Ranges for No Processing Error-Bar Plots

Graph Range	Default Location
X-Min Values	All cells in the A column, beginning in cell A2.
X-Mean Values	All cells in the B column, beginning in cell B2.
X-Max Values	All cells in the C column, beginning in cell C2.
X-Deviation	All cells in the D column, beginning in cell D2.
Y-Min Values	All cells in the E column, beginning in cell E2.
Y-Mean Values	All cells in the F column, beginning in cell F2.
Y-Max Values	All cells in the G column, beginning in cell G2.
Y-Deviation	All cells in the H column, beginning in cell H2.
Datapoint Labels	All cells in the F column, beginning in cell F2.
Color-coding	All cells in the F column, beginning in cell F2.
Legend Labels	Cell F1.

Range Highlighter for Column-Error Plots

The Range Highlighter for Column-Error plots allows you to view and/or specify five spreadsheet ranges for the chart.

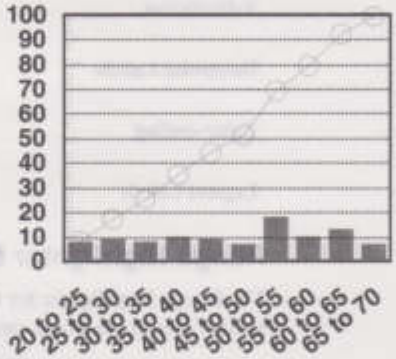
T1	A	B	C	D	E
1	X	X1	X2	Error X1	Error X2
2	Test 1	5	5.5	1.15	1.265
3	Test 2	10	11	2.3	2.53
4	Test 3	15	16.5	3.45	3.795
5	Test 4	20	22	4.6	5.06

Default Ranges for Column-Error Plots

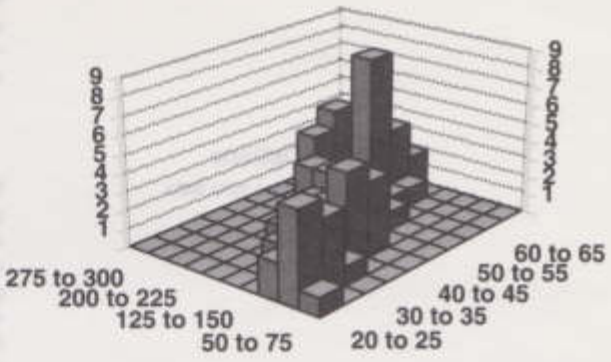
Graph Range	Default Location
Axis Labels	All cells in the A column, beginning in cell A2.
Bar Values	All cells in the B column, beginning in cell B2.
Error Values	All cells in the C column, beginning in cell C2.
Legend Labels	Cell B1.
Datapoint Labels	All cells in the B column, beginning in cell B2.

Histograms

The **Histogram** is an automatic processing graph. It calculates and displays the distribution of a single column of values.



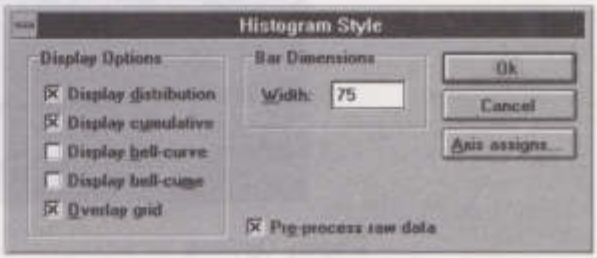
The **3-D Histogram** automatically processes input data. It calculates and displays the distribution of X-Y pairs in two columns of data.



Select **2-D** or **3-D Histogram (no processing)** to graph data that has already been processed.

Setting Styles for 2-D Histograms

The Histogram Style dialog box contains display options for the selected graph.



Display Options

Display distribution	Plots the calculated frequency distribution of the sampled data.
Display cumulative	Plots the calculated cumulative frequency distribution of the sampled data.
Display bell-curve	Plots the calculated Bell-curve distribution of the sampled data.
Display bell-cume	Plots the calculated cumulative Bell-curve distribution of the sampled data.
Overlay grid	Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Bar Dimensions

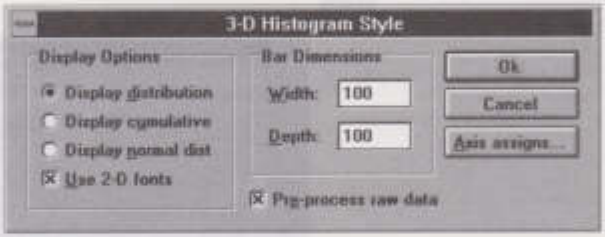
Width — Specifies the bar width. The maximum width of 100 places the bars immediately adjacent to one another with no intervening space. Minimum width is 0.

Other Options

Pre-process raw data — Causes automatic statistical processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is deselected, the input spreadsheet data is graphed. Note that if a new graph is created based on the output spreadsheet and pre-processing is deselected, the result is a graph of the processed data without a wait for processing.

Setting Styles for 3-D Histograms

The 3-D Histogram Style dialog box contains display options for the selected graph.



Display Options

Display distribution — Plots the calculated frequency distribution.

Display cumulative — Plots the calculated cumulative frequency distribution.

Display normal dist — Plots the calculated normal (Gaussian) distribution.

Use 2-D fonts — Forces axis labels to be horizontal non-rotated text.

Bar Dimensions

Width

Accepts entry of a number that adjusts the width dimension of columns. One hundred equals maximum width. Zero equals minimum width.

Depth

Accepts entry of a number that adjusts the depth dimension of columns. One hundred equals maximum depth. Zero equals minimum depth.

Other Options

Pre-process raw data

Causes automatic statistical processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is deselected, the input spreadsheet data is graphed. Note that if a new graph is created based on the output spreadsheet and pre-processing is deselected, the result is a graph of the processed data without a wait for processing.

Automatic Processing for Histograms

The automatic processing for a Histogram graph takes columns of data and sorts them into bins. The bins represent the number of samples in each range of values.

Default Ranges for Automatic Processing Histograms

If you choose the automatic processing version of the Histogram, the Range Highlighter is not available to the input spreadsheet, but the Helpful Hints dialog box shows the default ranges. Harvard ChartXL computes the statistics using the default ranges. A sample input spreadsheet, set up to match the default ranges for the Histogram, is displayed below.

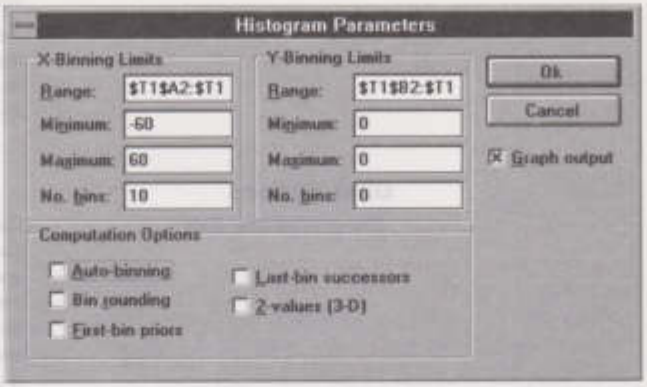
T1	A	B	C	D
1	AGE	Cholesterol Le		
2	24	106		
3	46	186		
4	66	193		
5	63	261		

Anything in the A column, starting in cell A2 will be binned for 2-D Histograms.

Anything in columns A and B, starting in the second row will be binned for 3-D Histograms.

Edit Processing for Histograms

Once the processing is completed, and the graph is drawn, you can change the ranges being calculated by clicking on the plotted data to select it, and choosing **Edit Processing** from the Graph menu.



X-Binning Limits

Range	Accepts entry of the spreadsheet range for the X data to be binned.
Minimum	Accepts entry of a minimum value for the X data.
Maximum	Accepts entry of a maximum value for the X data.
No. bins	Accepts entry of the number of sampling intervals.

Y-Binning Limits (for 3-D graphs only)

Range	Accepts entry of the spreadsheet range for the Y data to be binned.
Minimum	Accepts entry of a minimum value for the Y data.
Maximum	Accepts entry of a maximum value for the Y data.
No. bins	Accepts entry of the number of sampling intervals.

Computation Options

Auto binning	Automatically determines the number of X and Y sampling intervals. If deselected, permits entry of number of X and Y bins.
Bin rounding	Places the sample in the bin closest to the integer value of the rounded sample.
First bin priors	Accumulates any samples prior to the first bin and places them in the first bin
Last bin successors	Accumulates any samples succeeding the last bin and places them in the last bin.
2-values(3-D)	If selected, indicates processing for a two-variable 3-D histogram.

Other Options

Graph Output	Graphs the Histogram data from the output spreadsheet onto the selected graph. If deselected, histogram data is created but not graphed and the output spreadsheet is displayed.

Range Highlighter for 2-D No Processing Histograms

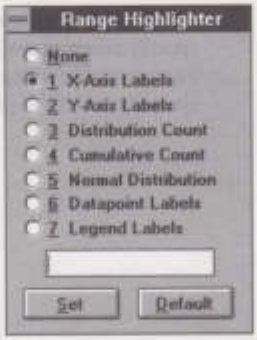
The Range Highlighter for 2-D Histograms allows you to view and/or specify seven spreadsheet ranges for the chart. This range highlighter is only available to the no processing version of the graph, or to the output spreadsheet of the processing version of the graph.

Default Ranges for 2-D No Processing Histograms

Graph Range	Default Location
Axis Labels	All cells in the A column, beginning in cell A2.
Legend Labels	All cells in the first row, beginning in cell B1.
Distribution Count	All cells in the B column, beginning in cell B2.
Cumulative Count	All cells in the C column, beginning in cell C2.
Normal Distribution	All cells in the D column, beginning in cell D2.
Normal Cumulative	All cells in the E column, beginning in cell E2.
Datapoint Labels	All cells in the B column, beginning in cell B2.

Range Highlighter for 3-D No Processing Histograms

The Range Highlighter for 3-D Histograms allows you to view and/or specify seven spreadsheet ranges for the chart. This range highlighter is only available to the no processing version of the graph, or to the output spreadsheet of the processing version of the graph.



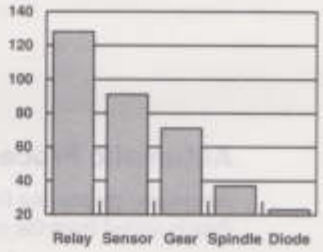
Default Ranges for 3-D No Processing Histograms

Graph Range	Default Location
X-Axis Labels	All cells in the A column of table 1, beginning in cell A2.
Y-Axis Labels	All cells in the first row of table 1, beginning in cell B1.
Distribution Count	All cells in table 1 of the spreadsheet, beginning in cell B2 and excluding the first row and the A column.

Cumulative Count	All cells in table 2 of the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Normal Distribution	All cells in table 3 of the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Datapoint Labels	All cells in table 1 of the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Legend Labels	Cell A1 in table 1.

Pareto Charts

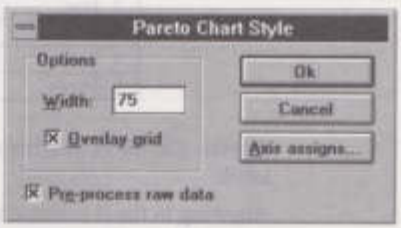
The **Pareto Chart** is an automatic processing graph. It automatically sorts column chart data in descending order. It is used in quality assurance tracking to identify and prioritize areas of greatest impact.



Select a **Pareto Chart (no processing)** graph type to graph pre-processed data.

Setting Styles for Pareto Charts

The Pareto Chart Style dialog box contains display options for the selected graph.



Options

Width

Accepts entry of a number that adjusts the width dimension of columns. One hundred equals maximum width. Zero equals minimum width.

Overlay grid

Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Other Options

Pre-process raw data

Causes automatic statistical processing of the supporting (input) spreadsheet and graphing of the resulting output spreadsheet. If pre-processing is deselected, the input spreadsheet data is graphed. Note that if a new graph is created based on the output spreadsheet and pre-processing is deselected, the result is a graph of the processed data without a wait for processing.

Automatic Processing for Pareto Charts

Automatic processing for Pareto Charts produces a graph in which the data is sorted from the maximum to the minimum values.

Default Ranges for Automatic Processing Pareto Charts

If you choose the automatic processing version of the Pareto Chart, the Range Highlighter is not available to the input spreadsheet, but the Helpful Hints dialog box shows the default ranges for data. A sample input spreadsheet, set up to match the default ranges for the Pareto Chart, is displayed below.

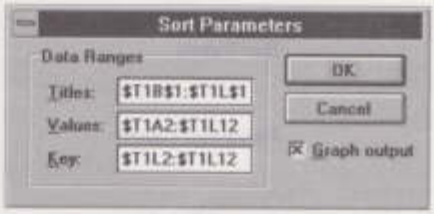
T1	A	B	C	D
1	0	Defects		
2	Gear	71		
3	Diode	23		
4	Relay	128		
5	Spindle	37		

Anything in the A column, starting in cell A2 will be used for category labels.

Anything in the B column, starting in cell B2 will be treated as data values. This is the column that will be used as the sort key.

Edit Processing for Pareto Charts

Once the processing is completed, and the graph is drawn, you can change the ranges being calculated by clicking the plotted data to select it, and choosing **Edit Processing** from the Graph menu.



Data Ranges

Titles — Accepts entry of the spreadsheet range to provide the sorted data titles.

Values — Accepts entry of the spreadsheet range to provide the data values to be sorted.

Key — Accepts entry of the spreadsheet range to be used as the sort key.

Other Options

Graph output — Graphs the sorted data from the output spreadsheet onto the selected graph. If deselected, sorted data is created but not graphed and the output spreadsheet is displayed.

Range Highlighter for No Processing Pareto Charts

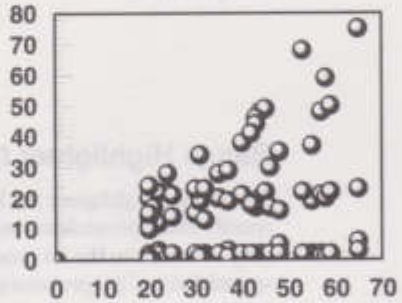
The Range Highlighter for Pareto Charts allows you to view and/or specify four spreadsheet ranges for the chart. This range highlighter is only available to the no processing version of the graph, or to the output spreadsheet of the processing version of the graph.

Default Ranges for No Processing Pareto Charts

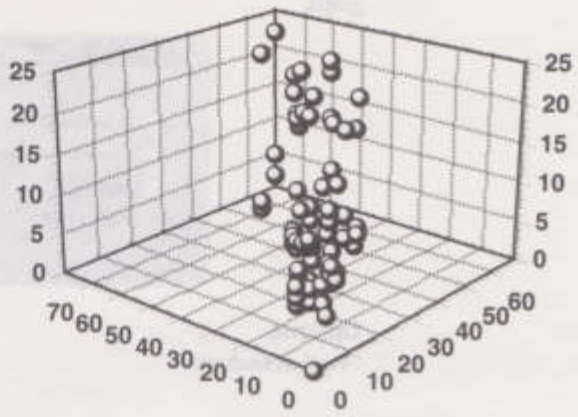
Graph Range	Default Location
Series Labels	All cells in the A column, beginning in cell A2.
Bar Values	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Datapoint Labels	All cells in the spreadsheet, beginning in cell B2 and excluding the A column and the first row.
Legend Labels	All cells in the first row, beginning in cell B1.

Scatter Plots

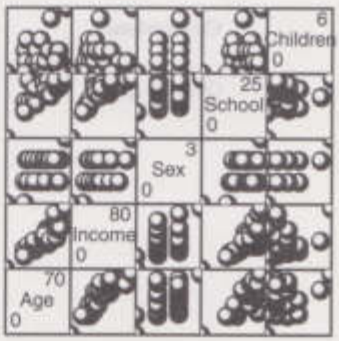
The **Scatter Plot** graphs data values as a series of unconnected points. The resulting point distribution is useful for analyzing or displaying the degree of positive or negative correlation between two variables. The degree and type of correlation is evidenced by the shape and direction of the pattern in relation to an imaginary line of dots which defines perfect correlation.



The **3-D Scatter Plot** graphs randomly spaced X, Y and Z triplets in three-dimensional space. It is used to visually identify correlations between data values.

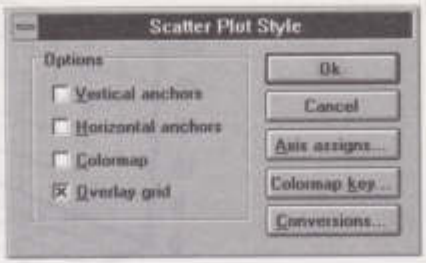


The **Linked-Scatter Plot** provides a method for linking different scatter plots into a matrix of scatter plots. This permits viewing the correspondence between point clusters on what would otherwise be different scatter plots. The Linked-Scatter Plot divides the plot area into rectangular segments bisected by a diagonal axis. This axis is divided into intervals, each with an upper and lower limit defined by the data series plotted in that segment.



Setting Styles for 2-D Scatter Plots

The Scatter Plot Style dialog box contains display options for the selected graph.



Options

Vertical anchors — Draws a line from each graph data point to the lower graph border. Serves to further highlight the X values of your data.

Horizontal anchors — Draws a line from each graph data point to the left graph border. Serves to further highlight the Y values of your data.

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Conversions — See *Conversions* for information about this option.

Overlay grid — Causes the major and minor axis grids, if displayed, to be placed on top of all other graph elements.

Setting Styles for 3-D Scatter Plots

The 3-D Scatter Plot Style dialog box contains display options for the selected graph.

Options

X-Z anchor — Draws a line from each graph data point to the X-Z plane.

Y-Z anchor — Draws a line from each graph data point to the Y-Z plane.

X-Y anchor — Draws a line from each graph data point to the X-Y plane.

Colormap — Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

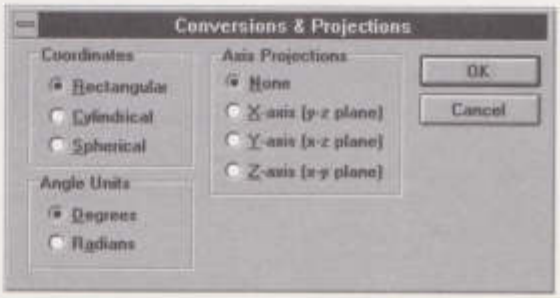
Conversions — See *Conversions* for information about this topic.

Other Options

Use 2-D fonts — Forces axis labels to be horizontal non-rotated text.

Conversions

Style dialog boxes for Scatter Plots, 3-D Scatter Plots, and some other types of graphs have a Conversion button. Click it to open the Conversions and Projections dialog box. This dialog box allows you to choose a coordinate system for your data or to project data onto the walls of the graph.



Coordinates

Rectangular	Interprets data to be in rectangular (Cartesian) coordinate system.
Cylindrical	Interprets data to be in cylindrical coordinate system.
Spherical	Interprets data to be in spherical coordinate system.

Angle Units

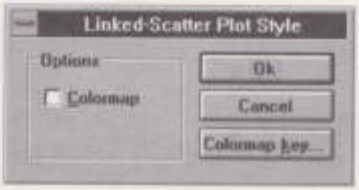
Degrees	Interprets angles in units of degrees.
Radians	Interprets angles in units of radians.

Axis Projections

None	Places data in its default orientation.
X-axis (y-z plane)	Projects 3-D data onto the Y-Z plane. Not valid for 2-D graphs.
Y-axis (x-z plane)	Projects 3-D data onto the X-Z plane. Not valid for 2-D graphs.
Z-axis (x-y plane)	Projects 3-D data onto the X-Y plane. Not valid for 2-D graphs.

Setting Styles for Linked-Scatter Plots

The Linked-Scatter Plot Style dialog box contains display options for the selected graph.



Options

Colormap

Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.

Range Highlighter for 2-D Scatter Plots

The Range Highlighter for Scatter Plots allows you to view and/or specify five spreadsheet ranges for the chart.

T1	A	B	C	D
1	0	Age	Income	Education
2	Ralph	20	20	11
3	Frank	21	17	12
4	Sherry	22	22	12
5	Charles	20	24	14

Default Ranges for 2-D Scatter Plots

Graph Range	Default Location
Datapoint Labels	All cells in the A column, beginning in cell A2.
X	All cells in the B column, beginning in cell B2.
Y	All cells in the spreadsheet, beginning in cell C2, excluding the first row and the A and B columns.
Color-Coding	All cells in the spreadsheet, beginning in cell C2, excluding the first row and the A and B columns.
Legend Labels	All cells in the first row, beginning in cell C1.

Range Highlighter for 3-D Scatter Plots

The Range Highlighter for 3-D Scatter Plots allows you to view and/or specify six spreadsheet ranges for the chart.

T1	A	B	C	D
1	0	Age	Income	Education
2	Ralph	20	20	11
3	Frank	21	17	12
4	Sherry	22	22	12
5	Charles	20	24	14

Default Ranges for 3-D Scatter Plots

Graph Range	Default Location
Datapoint Labels	All cells in the A column, beginning in cell A2.
X	All cells in the B column, beginning in cell B2.
Y	All cells in the C column, beginning in cell C2.
Z	All cells in the spreadsheet, beginning in cell D2, excluding the first row and the A, B, and C columns.
Color-Coding	All cells in the spreadsheet, beginning in cell D2, excluding the first row and the A, B, and C columns.
Legend Labels	All cells in the first row, beginning in cell D1.

Range Highlighter for Linked-Scatter Plots

The Range Highlighter for Linked-Scatter Plots allows you to view and/or specify four spreadsheet ranges for the chart.

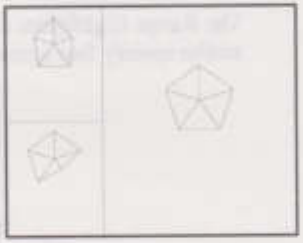
T1	A	B	C	D
1	0	Age	Income	Education
2	Ralph	20	20	11
3	Frank	21	17	12
4	Sherry	22	22	12
5	Charles	20	24	14

Default Ranges for Linked-Scatter Plots

Graph Range	Default Location
Datapoint Labels	All cells in the A column, beginning in cell A2.
Category Labels	All cells in the first row, beginning in cell B1.
Data Values	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Color-Coding	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.

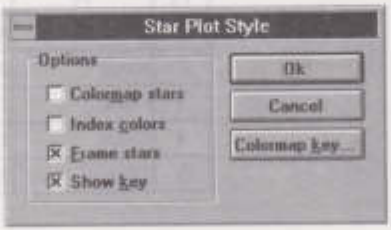
Star Plots

The **Star Plot** displays a series of separate scores for a group of categories. The Star Key provides a legend for each "arm" of the stars.



Setting Styles for Star Plots

The Star Plot Style dialog box contains display options for the selected graph.



Options

Colormap stars	Assigns colors to a range of graph values according to the settings made through the Colormap key button and through the Color Coding Range specified in the supporting spreadsheet.
Index colors	Assigns a different pre-set color fill to the star points in each star.
Frame stars	Surrounds each star by a frame.
Show key	Adds a key to the Star Plot showing the categories for each star point.

Range Highlighter for Star Plots

The Range Highlighter for Star Plots allows you to view and/or specify four spreadsheet ranges for the chart.

T1	A	B	C	D	E
1	0	English	Math	Geography	History
2	Mid-Term	90	54	96	40
3	Final	92	75	43	42
4					
5					

Default Ranges for Star Plots

Graph Range	Default Location
Star Name Labels	All cells in the A column, beginning in cell A2.
Star Point Labels	All cells in the first row, beginning in cell B1.
Star Point Values	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.
Color-Coding	All cells in the spreadsheet, beginning in cell B2 and excluding the first row and the A column.

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